# Final
# Nevada Brownfields Program
# Quality Assurance Program Plan

Establishing data quality requirements for environmental site assessments and site cleanups completed by the Nevada Brownfields Program and its statewide Brownfields Contractors

This document has been prepared by the Nevada Brownfields Program operating as part of the Nevada Division of Environmental Protection, Bureau of Corrective Actions

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ADQ | Audit of data quality |
| ASTM | American Society for Testing and Materials |
| CAP | Corrective action plan |
| CCAL | Continuing calibration |
| CEM | Certified environmental manager |
| CERCLA | Comprehensive Environmental Response, Cleanup, and Liability Act |
| CFR | Code of Federal Regulations |
| CLP | Contract laboratory program |
| CSM | Conceptual site model |
| CWA | Clean Water Act |
| DQA | Data quality assessment |
| DQI | Data quality indicator |
| DQO | Data quality objective |
| EDD | Electronic data deliverable |
| EDSC | Environmental Data Standards Council |
| ELCP | Environmental Laboratory Certification Program |
| EPA | U.S. Environmental Protection Agency |
| ELS | Environmental laboratory services |
| ESA | Environmental site assessment |
| FSP | Field sampling plan |
| GC/MS | Gas chromatography and mass spectrometry |
| HASP | Health and Safety Plan |
| HRGC/HRMS | High resolution gas chromatography/high resolution mass spectrometry |
| ICAL | Initial calibration |
| ICP/MS | Inductively coupled plasma (atomic emission spectrometry) and mass spectrometry |
| IDW | Investigation-derived waste |
| IRIS | Integrated risk information system |
| LCS | Laboratory control sample |
| LRL | Lowest reporting limit |
| MCL | Maximum contaminant level |
| MDL | Method detection limit |
| MQO | Measurement quality objective |
| MS/MSD | Matrix spike and matrix spike duplicate |
| MSR | Management system review |
| MTBE | Methyl-tert-butyl-ether |
| mg/L | Milligrams per liter |
| µg/L | Micrograms per liter |
| NAC | Nevada Administrative Code |
| NBP | Nevada Brownfields Program |
| NDEP | Nevada Division of Environmental Protection |
| NELAC | National Environmental Laboratory Accreditation Conference |
| NIST | National Institute of Standards and Testing |
| NPDES | National Pollutant Discharge Elimination System |

| | |
|---|---|
| NPL | National Priorities List |
| NRS | Nevada Revised Statues |
| PARCCS | Precision, accuracy, representativeness, completeness, comparability, and sensitivity |
| PE | Performance evaluation |
| PID | Photo-ionization detector |
| PRG | Preliminary remediation goal |
| PRQL | Project-required quantitation limit |
| QA | Quality assurance |
| QA/QC | Quality assurance/quality control |
| QC | Quality control |
| QCSR | Quality control summary report |
| QL | Quantitation limit |
| RBCA | Risk-based corrective action |
| RCRA | Resource Conservation and Recovery Act |
| RDA | Records disposition authorization |
| RFP | Request for proposal |
| RPD | Relative percent difference |
| %R | Percent recovery |
| SAP | Sampling and analysis plan (an integrated field sampling plan and QA project plan) |
| SDWA | Safe Drinking Water Act |
| SOP | Standard operating procedure |
| SOW | Statement of work |
| SQL | Sample quantitation limit |
| SVOC | Semivolatile organic compound |
| TCLP | Toxicity characteristic leaching procedure |
| TSA | Technical system audit |
| TDS | Total dissolved solids |
| VOC | Volatile organic compound |
| VSP | Visual sample plan |
| YSA | Yearly systems audit |

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## GROUP A: PROGRAM MANAGEMENT ELEMENTS

### Introduction

This Quality Assurance (QA) Program Plan describes the quality process for the Nevada Brownfields Program (NBP), under the Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA), 128a. This program has the primary goal of protecting human health and the environment while assisting in the assessment, cleanup and redevelopment of Brownfields properties. The NBP provides a process for streamlining government oversight of cleanups and redevelopment of environmentally challenged properties.

### A4: Program Organization

The NBP operates within the Bureau of Corrective Actions ("the Bureau") of the Nevada Division of Environmental Protection (NDEP). The Bureau functions as the consolidated source of environmental site cleanup in the State of Nevada, with authorities and responsibilities arising from delegated authorities through the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act (CWA), and from cooperative work agreements through CERCLA. The NBP, as defined, is a small component of the Bureau and consists of a single full-time employee with a line supervisor, whose authorities are divided over all Superfund/CERCLA-related activities for which the NDEP has involvement.

The NDEP does not have an office or position specifically devoted to quality assurance (QA) management. As such, data quality responsibilities reside primarily within each separate program. The NBP has designated a staff member as the NBP Quality Coordinator, who will be designated as the QA manager for all projects receiving Brownfields funding. The NBP Quality Coordinator may still rely on a number of division-wide, internal resources, as well as outside independent services to minimize any potential conflict involving the role that staff member may play in the direct generation of data. The NBP Program Coordinator and Quality Coordinator are independent of direct data generation activities over which they have oversight. These structures, resources, and processes will be outlined in the following two subsections governing program organization and planning documentation.

The NBP provides the following:

- Services for site assessments/characterizations to determine existence and extent of potential contamination.
- Cleanup and remediation services for sites with confirmed contamination.
- Potential to increase property values, create jobs, stimulate tax revenue and revitalize communities.
- The ability to take blighted property and prepare them for resale generating income to stakeholders.
- Empowerment for local governments and communities to develop partnerships for restoring abandoned, idled, or underutilized sites to new users.
- A process for streamlining government oversight of cleanups and redevelopment.

## A4.1 Program/Task Organization

The NBP, as described in the next chapter (A5: Problem Definition and Background), performs site assessments and cleanups on behalf of applying eligible entities statewide. The operation of this program involves a number of parties with specific responsibilities related to data quality; these individuals represent four different organizational entities with specific functions related to the operation of Brownfields. The following paragraphs discuss these organizations and their general responsibilities, followed by discussions of specific responsibilities held by various individuals within those organizations.

An organizational chart showing all the parties involved in the data quality system has been included as Figure A1: Quality System Components of the Nevada Brownfields Program. Entities are identified based on their roles in data quality management as data generators or data users. The defined NBP is highlighted in color and includes the Superfund and Brownfields Branch Supervisor, the Program Coordinator, the Quality Coordinator, and the three Statewide Brownfields Contractors. Also highlighted in color are the representatives of the National Brownfields Program operated by the United States Environmental Protection Agency (EPA). The data users include the program applicant, local government representatives, and the property owner; depending on the project, these three identified units may be synonymous, or they may represent distinct stakeholders, each with specific and different data needs. Program applicants may include local governments or property owners.

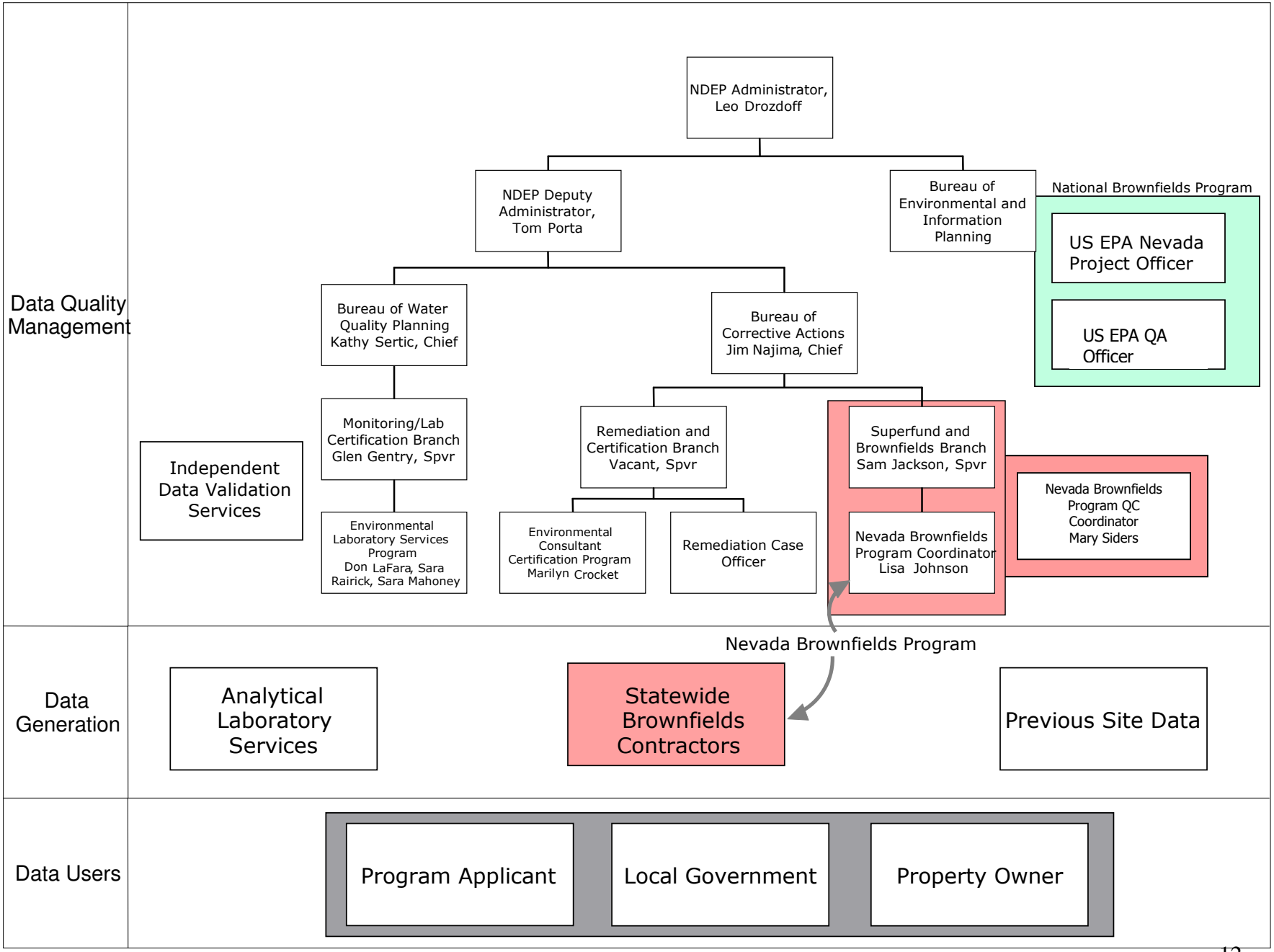
Under the NBP, grant applications are submitted for review by the Program Coordinator. The NBP Program Coordinator reviews and approves applications, and assigns the best contractor for the job, based on project workloads, geographic location, and company resources. Following approval of an application and selection of a contractor, a scoping meeting is used to evaluate project needs. Either a site assessment or site cleanup will be performed by the contractor. Site redevelopment is the goal after remediation is completed.

### *A4.1.1 Organizational Roles and Responsibilities*

Environmental Protection Agency

The federal government, through the EPA, operates the national Brownfields Program, which serves as the guiding model for the NBP. Additionally, the EPA is the source of funding for the Program through the Section 128—State Response Program Enhancement mechanism (42 USC Sec. 9628), as established by the National Brownfields Act. Because the EPA maintains the program model and provides the program funding, its roles and responsibilities are to ensure that the NDEP is conforming to appropriate program guidelines and meeting various terms and conditions attached to the grant funding. The Terms and Conditions statement attached to the funding dictates various aspects of the NBP including the eligibility of projects for funding and the generation of data in accordance with federally established quality assurance/quality control (QA/QC) guidelines. As laid out in other sections of this QA Program Plan, the EPA has a role in both program-level (establishment and documentation of appropriate data quality structures) and project-level (determination of project eligibility and involvement in data collection planning) QA procedures.

# Figure A1: Quality System Components of the Nevada Brownfields Program



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Nevada Division of Environmental Protection

The NDEP is responsible for the operation of the NBP. All programmatic activities reside in the Bureau of Corrective Actions, Superfund and Brownfields Branch. The NBP consists of a supervisor and a staff-level full-time employee, both of whom are responsible for the full implementation of the program. Also within the Bureau of Corrective Actions is an environmental consultant certification program that establishes standards and documents compliance for operation as a certified environmental manager (CEM) in the State of Nevada.

Environmental laboratories that analyze water samples for compliance purposes must be certified by the State or the EPA. The NDEP Bureau of Water Quality Planning certifies environmental laboratories for drinking water and wastewater analysis through the Environmental Laboratory Certification Program (ELCP). The primary mission of the ELCP is to provide guidance, expertise and regulatory oversight to certified environmental laboratories for the purpose of ensuring public access to competent and reliable laboratory services. The data produced from the analysis of environmental samples are used to make informed decisions relating to the health and welfare of Nevada's citizens. These data must be of known quality, technically sound and legally defensible. The ELCP is used to maintain oversight on analytical labs for quality control (QC) on all environmental samples submitted for analysis under a regulatory program—either the CWA, Safe Drinking Water Act (SDWA), and RCRA. The NBP will rely on the laboratory certification program for the satisfaction of many of the QC elements associated with laboratory operation and reporting (see Appendix A of this QA Program Plan). Managers for the NDEP and the Bureau also have responsibilities for the successful functioning of all component programs, and therefore play a role in the NBP as well.

Environmental Consultants for the Nevada Brownfields Program

Data generation is accomplished by the NBP through the services of contracted environmental consulting firms. Consultants are selected through a formal request for proposal (RFP) bidding process every two years. During each selection process, three firms are retained for the statewide performance of all environmental assessment and cleanup activities under the NBP. These companies become responsible for all data generation activities in support of the NBP through field measurements and the subcontracting of analytical laboratory services. Their direct contractual relationship with the NDEP makes them an integral component of the NBP, and they must operate to meet all data quality requirements as established in this QA Program Plan to ensure the sufficiency of submitted information. The selected firms also operate under their own corporate- or office-level QA plans that may be considered as a component in the overall structure of QA for the NBP. The QA plans of firms are generally for liability issues and best business practices; the firms must adhere to the NBP QA Program Plan.

Eligible Applicants for the Nevada Brownfields Program

The NBP operates on behalf of its program applicants, so it is these entities that most often define project scopes and project goals. Eligible entities, who for the most part under the Program are usually a municipal or county government, apply to the NBP for services at a site to meet an established goal, such as the satisfaction of all-appropriate inquiry regulations or the completion of a cleanup and the issuance of a “No Further Action” letter by the NDEP. It is

these defined goals and the needs of the applicants as the primary data user that drive the types and levels of data generation undertaken at a Brownfields project. For this reason, the program applicants play a critical role in the scoping and planning of projects prior to data generation. They have an additional interest in ensuring that the final product delivered by the NBP satisfies their expectations of project goals. Program applicants may include local governments or property owners. The NBP Program Coordinator reviews applications and determines if the site is eligible, not eligible, or of uncertain eligibility; for the latter case, the Program Coordinator will consult with the EPA. At present, all eligible applicants are taken, but should the program grow, sites will be ranked as to priority for funding.

### *A.4.1.2 Individual Roles and Responsibilities*

In addition to those general responsibilities maintained by the above organizations, specific responsibilities for QA have been assigned to individuals involved in the NBP. Most of these individuals will be referred to only as a given project title or position, since these assigned duties will be unaffected by staff changes within these positions. However, the designated Quality Coordinator for the NBP will be identified by name, and a revision to the QA Program Plan will be required at any point that a staff change occurs in this position. Individuals are listed below corresponding to the four previously listed organizational structures and according to the level of direct oversight within those organizations the individuals will provide in the NBP's QA system from least to most direct involvement.

<u>EPA Region 9, Nevada Project Officer</u>

The EPA Nevada Project Officer is the lead federal agent in the administration of cooperative agreements between the EPA and NDEP related to Superfund and State Response Program. However, the EPA Project Officer for Superfund projects may not be the same person managing Brownfields projects. The EPA Nevada Project Officer is the individual with the ultimate responsibility in determining whether the NBP at both a program and project level is complying with all federal program guidelines as dictated by funding Terms and Conditions. In order to facilitate the EPA Nevada Project Officer's responsibilities for program oversight under the Cooperative Agreements, copies of all correspondence and data reports are transmitted to their attention for inclusion in project files they maintain.

The EPA Nevada Project Officer will be consulted prior to acceptance of a site into the NBP, in cases where there are questions regarding project eligibility, in order to align the state program with the mandates of the federal program. Initial discussions of applicant eligibility, site eligibility, and project goals will be discussed during this consultation. The EPA Nevada Project Officer may require of the NBP any and all documentation to demonstrate the eligibility of a project prior to the use of grant funds at that site. At sites that clearly meet the definition of a Brownfields and satisfy all eligibility requirements, the NBP Program Coordinator will make the determination and documentation will not be necessary, but where questions regarding a site arise, a detailed rationale for inclusion will need to be submitted to the EPA Nevada Project Officer for review prior to acceptance of an application.

An invitation will be extended to the EPA Nevada Project Officer for participation in initial project scoping sessions to be held between the NDEP, Brownfields consultants, and program

applicant for the discussion of project goals, data quality objectives (DQOs), and scope of services development. Participation by the EPA Nevada Project Officer is not mandatory in these sessions, but sufficient advanced notice and all reasonable accommodations will be made by the NDEP to allow for EPA involvement in project planning.

EPA Region 9, Quality Assurance Office

Staff in the QA Office of EPA Region 9 will have direct oversight in the development and review of the NBP QA Program Plan and indirect involvement in the development and review of site-specific sampling and analysis plans (SAPs).

Prior to the implementation of QA elements as outlined in this QA Program Plan, this document will be reviewed and approved by the EPA QA Office. Revisions will be made in accordance with EPA-provided comments until the QA Program Plan is finalized. Once the document is finalized, any proposed revisions to the QA Program Plan will need to be considered by the EPA QA Office prior to inclusion in a revised document. Any substantial deviations from the prescribed performance of QA elements as outlined in the approved QA Program Plan will need to be documented and submitted as part of a Yearly Systems Audit (YSA) prepared by the NBP Quality Coordinator (the YSA is described in Section C of this document) or through another acceptable method if the deviation requires attention prior to the scheduled date of the YSA. The QA Office will be responsible for reviewing YSAs submitted by the NDEP and making recommendations for corrective actions where elements are found not to be in compliance with the QA Program Plan.

Less direct involvement by the EPA QA Office is planned for the development and review of project-specific SAPs. The primary responsibility for the review and approval of project-specific plans will reside with the NDEP; however, the EPA QA Office will be invited to attend all initial project-scoping sessions for the discussion of project goals, DQOs, and scope of services development. Participation by the EPA QA Office is not mandatory in these sessions, but sufficient advanced notice and all reasonable accommodations will be made by the NDEP to allow for EPA involvement in project planning. At least once a year, as an element of the YSA, a project-specific SAP will be submitted for review to both the NDEP and EPA QA staff. This dual review will help the NDEP align, through the comparison of plan review comments, its QA requirements with the practices used by the EPA. Conclusions reached through the dual review will be documented in the YSA, along with plans for the implementation of proposed corrective actions.

The EPA QA officer will concurrently review at least one SAP per year generated in the NBP. Additionally, EPA may choose to review one SAP as an audit function; this SAP will have been reviewed and approved by the NDEP prior to EPA's audit review. The EPA QA officer will select a representative SAP, based on their professional judgment, or the EPA QA officer may request that the NBP Quality Coordinator select a representative SAP based on his or her professional judgment.

NDEP Administrator and Deputy Administrators

Management functions for the NDEP are handled through the office of the NDEP Administrator, who has responsibilities for the successful operation of all divisional programs. Division-wide policies are established and implemented through the authorities of the Administrator and Deputy Administrators, who operate as the representative of the NDEP in state statutes and regulations. Division-wide policies established by the Administrator cover all aspects of the operation of the Division's personnel management, accounting, quality management, information security, and budgeting systems.

NDEP Environmental Laboratory Services

The NDEP operates an environmental laboratory certification program for the purpose of ensuring the citizens of Nevada access to quality analytical services. Certification for environmental laboratories is required for the analysis of samples associated with the CWA, the SDWA, and RCRA, which serve as the three primary regulatory authorities for site cleanup under State law. Projects under the NBP are required to use analytical laboratories certified by the State of Nevada. The responsibility of laboratory certification resides in the NDEP Bureau of Water Quality Planning, Environmental Laboratory Services (ELS) section. To accomplish their objective of ensuring the availability of competent, reliable laboratory services, the ELS group undertakes the following activities:

- Technical assistance—staff members of the ELS have been hired based on their years of experience with analytical procedures, instrumentation, methodologies, and QA measures. The staff serves as a technical resource for laboratories, the general public, and other NDEP programs in these areas of expertise.

- Dissemination of pertinent information—when the EPA promulgates new methodologies, regulatory levels, detection limits or when industry standards change or laboratory technology is updated, these changes are incorporated into the ELS program and disseminated to laboratories and the regulated community.

- Certification process—the certification program follows the guidelines presented in Chapter 4 of the National Environmental Laboratory Accreditation Conference (NELAC); Constitution, Bylaws, and Standards which is referenced in the Nevada Administrative Code (NAC). Those relevant NACs are included as Appendix A to this QA Program Plan.

The application for laboratory certification in Nevada requires general information about the laboratory (including the primary accrediting authority), submittal of the laboratory's QA plan, a copy of the most-recent site inspection, demonstration of capability and submittal of method detection limit data, results of performance evaluation (PE) samples, and NELAC certifications. Additionally, the names and contact information for laboratory managers and staff must be provided, along with worksheets indicating the types of analyses and analytes for which the laboratory wishes to be certified. Requirements for certification by the State of Nevada are provided in Appendix A of this QA Program Plan.

Chief, Bureau of Corrective Actions

The Bureau of Corrective Actions of the NDEP is responsible for a consolidated set of site cleanup regulations and authorities. All site cleanups conducted in the State of Nevada are overseen by the Bureau of Corrective Actions through its combined authorities from state-delegated environmental programs including the CWA and RCRA. As the head of the Bureau of Corrective Actions, the Chief is responsible for the administration of all these cleanup authorities. In addition, because site cleanup regulations play an integral part in the development of data quality guidelines, the Chief also plays an important function in determining data quality and sufficiency for all programs under the Bureau of Corrective Actions and specifically for the NBP.

The regulations governing "corrective actions" (the collective term for state-lead cleanups in Nevada) determine on a general level the type and amount of data necessary to make cleanup decisions, including the issuance of "no further action" letters. The Chief is responsible for ensuring a consistent application of these regulations across all state cleanup sites. All site information is available to the Chief for review and consideration of site decisions. The Chief also holds regular, usually weekly, supervisor-level meetings to discuss Bureau issues and program operations.

In addition to overseeing compliance with existing regulations, the Chief is the primary driver for the initiation of new regulations or the revision of those existing ones found to be insufficient to handle current case operations. The Chief has a number of resources available to help identify regulatory deficiencies. After these deficiencies are identified, the Chief will initiate a defined process for the drafting and adoption of regulations. Statutory authority for corrective actions is given by the Nevada Revised Statutes, Title 40: NRS 459.500-459.535; NRS 459.800-459.856; NRS 590.700-590.920; NRS 445A.010-445A.730 (see http://www.leg.state.nv.us/NRS/). The Nevada Administrative Code (NAC) is the State of Nevada's code of state regulations and carries the same force of law as the NRSs.

The Chief will also receive QA information specific to the NBP, including the results of YSAs and any other audits initiated by the Program Supervisor. The Supervisor will consult with the Chief when implementing any Program corrective actions, as recommended through these audits.

Nevada Brownfields Program Coordinator

All environmental cleanups undertaken in the State of Nevada are overseen through the designation of a remediation Case Officer in the Bureau of Corrective Actions. The Case Officer is responsible for reviewing and approving cleanup plans and closure reports to ensure that cleanups are conducted in accordance with the environmental authorities contained in state statutes and regulations. All Brownfields cleanups will be required to satisfy cleanup authorities in the NAC 445A.226 to 445A.22755.

For cleanups funded by the NBP, the NBP Program Coordinator is typically the Case Officer responsible for review and state oversight of the NBP site. The NBP Program Coordinator will be the primary data user and decision maker with authorities to determine whether the cleanup actions taken by the environmental consultant at the direction of the NBP satisfies environmental

regulations. The NBP Program Coordinator will dictate the appropriateness of selected action levels for contaminants in soil and groundwater, and will make risk-based determinations regarding any contaminants left in place above these levels.

Specifically, the NBP Program Coordinator will review Corrective Action Plan (CAP) submitted by the environmental consultant. Prior to initiation of cleanup activities, the Program Coordinator, functioning as the Case Officer for Brownfields projects, will first need to provide approval. The Program Coordinator may indicate deficiencies in the CAP that will need to be addressed prior to approval. Additionally, he/she will review the final report produced after completion of the cleanup in determining whether to issue a "no further action" letter for case closure.

Supervisor, Superfund and Brownfields Branch, Bureau of Corrective Actions

The Supervisor of the Superfund and Brownfields Branch of the Bureau of Corrective Actions is responsible for administrative functions associated with the operation of two cooperative agreements with the EPA. In addition to the NBP, these cooperative agreements cover activities associated with emergency response, the performance of preliminary assessments and site investigations under CERCLA, the Carson River Mercury Superfund site, development of an abandoned mine lands program, and release reporting.

The responsibilities of the Superfund and Brownfields Branch Supervisor are primarily associated with program operation and fiscal management. At the program level, the Supervisor is responsible for shaping the NBP by negotiating budgets and work plans with the EPA Region 9 each year and by organizing quarterly discussions with the EPA Nevada Project Officer for the purposes of program review.

This position is also responsible for reviewing and participating in an YSA review for the NBP and integrating any conclusions or corrective actions into future program work plans. The Supervisor has the authority to implement any QC element or corrective action at the program-level at any time in order to satisfy concerns or comments made by any participating party in the NBP. This may include such situations as the program-wide enforcement of a revised regulatory action level, a requirement for increased documentation to satisfy public interest in particular projects, and identification of mandatory training opportunities for staff and consultants.. The Supervisor also has the authority to initiate any additional audits, beyond the YSA, in response to adverse or unusual operating conditions.

The Superfund and Brownfields Branch Supervisor is also responsible for all contract management issues, including the selection of the statewide Brownfields consultants through the RFP process, the negotiation of contracts with the selected firms, the establishment of project budgets, and the review of submitted invoices.

Nevada Brownfields Program Quality Coordinator

The daily administration of the NBP is handled by the NBP Program Coordinator. However, some program oversight activities involved with data quality for site cleanup are handled as part of the Quality Coordinator's responsibility to ensure data submitted to the program by its environmental consultants meet appropriate levels of quality. The Quality Coordinator has the

primary responsibility for the maintenance of the QA Program Plan and for ensuring that all data submitted to the NBP meets the requirements in this document. This is done through four major activities:

1. Review and Revisions of the QA Program Plan — the QA Program Plan will need to be updated to accommodate new developments in QA/QC or to respond to changes in NBP functions. Revisions to the QA Program Plan may become necessary through several different routes, and the Quality Coordinator will be responsible for responding and making these revisions when appropriate. During regular contact with the EPA, most usually during scheduled quarterly program review meetings, either the EPA Nevada Project Officer or QA Officer may make suggestions for improving quality performance that could be incorporated into the QA Program Plan. During the YSA, the NBP Quality Coordinator will examine the QA Program Plan and the performance of the NBP and may make suggestions for improved performance that result in revisions to the QA Program Plan. Likewise, the three Brownfields environmental consultants may request revisions to the QA Program Plan in response to changes in industry-wide field methodology or for the addition of new or innovative technologies. Development and acceptance of new analytical methods may provide lower detection limits or other improvements that can be described in revisions to the QA Program Plan.

2. Review and Approval of SAP/FSP—the Quality Coordinator will have the ultimate responsibility to review site-specific SAPs or Field Sampling Plans (FSPs) submitted by the statewide Brownfields contractors to ensure compliance with provisions of the approved QA Program Plan. The Quality Coordinator will review the submitted SAPs and FSPs to determine whether the sampling event will satisfy project goals and includes sufficient QC elements to ensure appropriate data quality.

3. Development of DQOs—prior to the preparation of SAPs by the Brownfields contractors, an initial scoping session will be held with all available stakeholders to outline project goals and DQOs. These initial meetings will roughly follow guidance for the standard DQO process developed by the EPA (EPA 2006a). The results of these initial meetings will be used to guide the development of the site-specific SAP and will be documented as part of the SAP preparation. The developments of DQOs will be a collaborative process, overseen by the NBP Quality Coordinator, to include the EPA Region 9, site applicant, appropriate local authorities, and the selected site contractor.

4. Review of Data Reports—upon submittal of a report containing environmental data, generated under an approved SAP, it will be the responsibility of the NBP Quality Coordinator to review the report to determine conformance with the SAP and QA Program Plan.

The NBP Quality Coordinator will prepare comments for revision of the data reports prior to finalization and delivery to the program applicant for their use.

Statewide Brownfields Environmental Consultants, Project Leads

Every two years, the NBP selects three environmental consultants to perform site assessments and site cleanups during a two-year contract period. These consultants are selected through an open, competitive bidding process dictated by State regulations governing the RFPs for outside services. A contract with the consultant may be extended for an additional two-year period without the need for a RFP. The consultants are required to operate within the dictates of the NBP as established in the contract.

As the primary data generators, the consultants are responsible for the implementation and documentation of a number of QC elements to satisfy requirements of the QA Program Plan. Beyond the elements contained in the QA Program Plan, the environmental consultants will be required to prepare a site-specific SAP or FSP for review by the NBP prior to any data collection activities at a Brownfields project site.

The consulting firms may also operate under their own, internal QA plans, but all work must still satisfy the approved QA Program Plan. As firms contracted to the State for the generation of environmental data, these internal QA plans should be made available for review by request by the NDEP and EPA. Although all necessary QC elements should be covered in the QA Program Plan and site-specific SAP/FSPs, the review of the corporate data quality documents maintained by the consultants may be undertaken to supplement the quality dictates of the NBP.

Program Applicants

Program applicants are the primary data users in the NBP; they may also be the primary data generators. Program applicants may include local governments or property owners. Assessments undertaken by the NBP will be used in redevelopment decisions and site cleanups will be guided by intended property reuse. As the primary data generators the program applicant will play three roles in determining the quality of data generated by the program. First, as part of the application and initial project planning process, the applicant will provide existing site information, including information from prior sampling events. This existing information will be reviewed by the NDEP and its environmental consultant to determine the appropriateness for its use by the NBP. If the data are of sufficient quality, they may be used in the program. Secondly, the program applicant will dictate their project needs by participating in and providing input during all planning efforts. These project needs will determine the amount and type of data to be generated by the environmental consultants. Planning helps ensure that data of adequate quality and quantity are collected. Thirdly, the program applicant will have the opportunity to review and provide comments on the completed data reports as an essential component in determining if the data of sufficient quantity and quality have been collected to meet project needs. Reviewing data in light of the project DQOs will help determine if the objectives have been met.

## A4.2 Planning Documentation

Although all activities undertaken by the NBP will be unique, one-time events associated with a site assessment or site cleanup project, those activities will occur within a framework that is well-defined by specific documentation requirements. Most interactions among the myriad of individuals and organizations involved in a single Brownfields project will be conducted through

a coordinated flow path consisting of the submittal and review of documents. Therefore, each defined document will play a role in establishing QC elements to ensure the production of a usable, reliable final product. Outlined below are the defined documents/deliverables that will constitute a normal Brownfields assessment or cleanup project, listed in the order that those documents will be produced during a project. Although the documents required for drafting and transmittal after the SAP, FSP or CAP are not considered planning documents, they will still be outlined here. A final section will be devoted to the documentation of projects that deviate from the established process and the documentation and use of previously generated data. Latter chapters will discuss other documentation issues, particularly the development of audits and program outputs to EPA databases.

A flow chart, corresponding to the flow of documents and data as outlined in this section has been included as "Figure A2: Program Inputs and Deliverable Flow." Only those parties with an active role in the generation and review of Brownfields deliverables are included in the flow chart. The numbered arrows correspond to the following documents and inputs:

1. Application to the NBP

A project to be undertaken by the NBP will be initiated by the submittal of a completed application by the party to be designated the Program Applicant. Application must be made in full on the form approved by the NDEP (Appendix B). In most instances the Program Applicant will be an "eligible entity" as defined in Section 104(k) of CERCLA, meaning that the applicant will be a unit of local government or redevelopment agency chartered or sanctioned by the State. Applications by private individuals who are property owners or prospective purchasers of Brownfields sites may also be considered, but they must demonstrate that the project has community benefit and support and must show the active involvement of appropriate local officials. Applications are accepted by the NBP at any time during the year.

The primary purpose of the application is to help the NBP Program Coordinator determine whether a project meets site and applicant eligibility requirements. In order to receive funding through the NBP, the application must demonstrate that the site meets the definition of a Brownfields, as established by the federal program in CERCLA Section 101(39). The site must not be on the National Priority List (NPL) or be the subject of on-going enforcement actions by the State or Federal government. The applicant must not be responsible for the contamination present at the site. These eligibility requirements are dictated by Section 128 grant funding Terms & Conditions.

The application is also intended to help the NDEP rank sites for funding. Priority will be placed for funding of projects with well-defined project goals or re-use strategies. Projects with defined end-uses are more likely to achieve completion within the NBP because project goals and data needs are more easily determined. Other ranking criteria are roughly modeled on those used in the federal competitive grants.

Along with the completed application form, the program applicant is also requested to submit any previously generated data available for the site. The use of previously generated data will be covered in other sections of this QA Program Plan. In general terms, these data are used to help define project goals and data needs. The submittal of previously generated data reports is

voluntary, and an application can be found to be sufficient based solely on responses to the questions contained on the approved form.

2. Brownfields Project Approval Letter

In response to an application, the NDEP will determine whether to fund or deny the proposed project. In declining to undertake a project, the NDEP will provide correspondence to the applicant with an explanation for the denial. A denied application will be kept on file, but no further action will be undertaken. Approval of an application and acceptance into the NBP, however, will generate correspondence from the Program Coordinator to the applicant that serves several purposes.

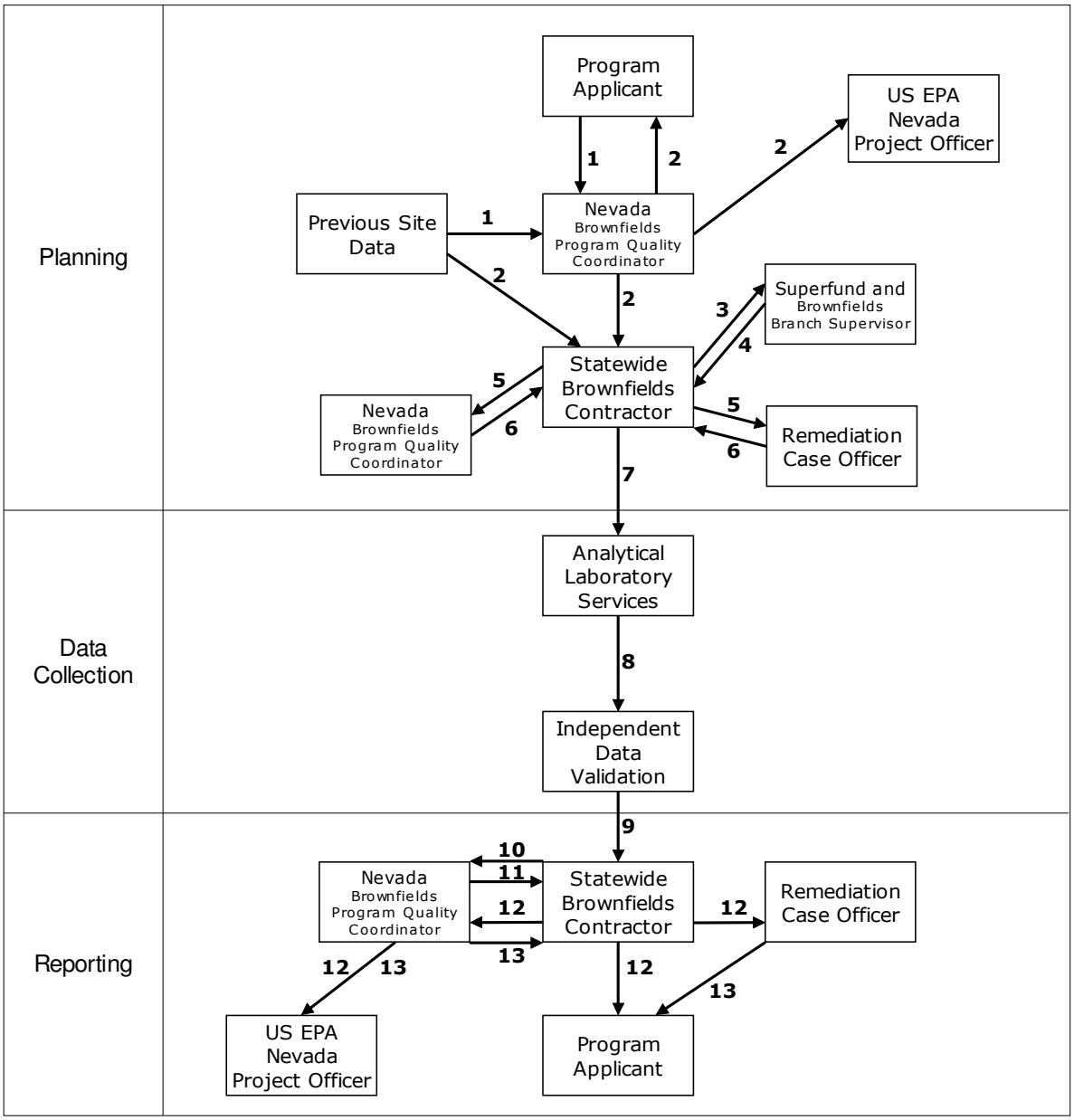
The NBP will approve a project and dictate the terms of funding, based on information provided in the application. For tracking and budgeting purposes, the approval letter will document whether the project is being undertaken as an assessment or cleanup project and also whether the project will be considered as "petroleum" or "hazardous substances." In most instances, projects undertaken by the NBP will be provided a commitment for full-funding at the time of approval; however, in those instances where a project will only be partly funded, the approval letter will spell out what specific project elements will be funded, thereby dictating data generation needs.

At the time of application approval, the NDEP will task one of its three Brownfields consultants to undertake the project, and this selection will be indicated in the approval letter. The selection of the consultant will be made by the NBP Program Coordinator based on considerations of project workloads, geographic locations, and company resources. The program applicant will be contacted by telephone prior to selection of the consultant to allow them to provide input regarding any preference they may have between the firms. The NBP Program Coordinator will try to accommodate the applicant's preference if it does not change cost and the firm is appropriate for the particular project. The selected consultant will also receive a copy of the approval letter, and the complete project application will be transmitted to the consultant to allow them to familiarize themselves with the project.

The approval letter will also serve as a data transmittal mechanism to the EPA. A copy of the approval letter will be sent to the EPA Nevada Project Officer, along with the complete project application as an attachment for the files at EPA Region 9. In most instances, the EPA Nevada Project Officer will not be consulted prior to acceptance of a project into the NBP, and the approval letter will serve as the first notification of the intention to undertake a project. However, if there are questions regarding project eligibility, the NBP Program Coordinator will seek prior concurrence from the EPA Nevada Project Officer through a technical justification memo.

The approval letter will also establish timelines for project planning; most importantly, through the proposal of dates for project scoping meetings. In order to meet development deadlines that are typically associated with Brownfields projects, a priority will be placed on holding initial planning discussions with the applicant and Brownfields consultant as soon as possible after approval of an application. The EPA Nevada Project Officer and QA Office will be invited to attend all initial planning meetings, and where timelines for initial planning meetings are

# Figure A2: Program Inputs and Deliverable Flow



incompatible with EPA staff schedules, attempts will be made to hold project scoping meetings during SAP/FSP development to encourage EPA participation.

3. Site-Specific Scope of Work

Contracts are negotiated with the three Brownfields consultants every two years, establishing much of the contractual relationship between the consultants and the NDEP. However, specific Brownfields projects are only undertaken through the establishment of site-specific budgets, through a statement of work (SOW). During initial planning activities, the consultant will start to develop a SOW to cover all project tasks with corresponding budget projections. Because the SOW and project budget are established early in the planning process, the projected project budget may be open for revision at later stages of the project, but only through an approved change order or supplemental budget request. Negotiation of the project budget is a function only between the NDEP and the consultant. No other parties will be involved in this process, though budget information will be made available upon request by the program applicant, property owner, local government, or EPA.

4. Scope of Work Approval Letter

The Supervisor of the Superfund and Brownfields Branch, who serves as the contract manager for the NBP, will review the site-specific SOW submitted by the contractor and, along with the NBP Program Coordinator, determine the appropriateness of the project tasks and budget. Project budget approval will be granted through written correspondence. The approval letter will serve two main functions: (1) it will establish a not-to-exceed budget total for consultant activities and, (2) it will establish a project start date for consideration of invoice payment. For projects where both assessment and cleanup activities are anticipated to occur, the approval letter will indicate whether the activities will be tracked as assessment or cleanup.

5. Field Sampling Plan, Sampling and Analysis Plan, and Corrective Action Plan

The primary planning document for data generation activities will be prepared by the Brownfields environmental consultant after initial project scoping meetings established and directed by the NBP Program and Quality Coordinators. The specific type of document submitted and the information required to be presented will be dependent on the type of project being undertaken. The three types of acceptable planning documents are a SAP, an FSP, or a CAP.

Assessment activities will require the drafting of either a SAP or an FSP by the consultant, dependent on the anticipated scope of the project and the constituents to be analyzed. Where an assessment project only involves total petroleum hydrocarbons, common chlorinated solvents, metals, or any other constituent for which standard operating procedures (SOPs), analytical methods, and measurement quality objectives (MQOs) have been adopted in this QA Program Plan, that project may be undertaken under the guidance of an FSP. Otherwise, the assessment project must be documented in planning through the development of a SAP.

An FSP or SAP drafted by the consultant must be in the form of the approved templates as developed by the EPA Region 9 and adapted for use in the NBP. These templates are provided

in Appendix C of this QA Program Plan. Most of the information necessary for inclusion in the FSP and SAP will be discussed during the initial scoping meetings, and it will be the responsibility of the consultants to accurately record and apply these discussions in the planning documents. Where appropriate, consultants may also make reference in these planning documents to information already contained in the QA Program Plan.

For cleanup projects, the consultant will be required to draft and submit a CAP, required by regulation for all cleanups undertaken in the State (NAC 445A.2271 and 445A.2273). Because nearly all cleanup actions require the collection and evaluation of environmental data, the CAP will need to be accompanied by an FSP or SAP, dependent on the conditions as discussed for assessment projects. When cleanup actions are planned at a site where assessment activities were previously performed by the NBP under an approved SAP or FSP, the CAP will need to be accompanied only by an amendment to cover activities not expressly identified in the SAP or FSP.

Planning documents will be submitted to the NDEP by the Brownfields consultant for review. No assessment or cleanup activities involving data generation will be undertaken until approval of the planning documents. Primary responsibility for review of assessment planning documents will reside with the NBP Quality Coordinator. CAPs will be reviewed by both the NBP Program and Quality Coordinators. Draft versions of the planning document will also be transmitted, either in an executive summary format or as a full version, to all other project stakeholders with sufficient time allowed for review and comment.

6. Planning Documentation Approval Letter

After review of the document, the NDEP will take one of three actions through written correspondence to the environmental consultant. If the SAP or FSP is found to be fully satisfactory, the NBP Quality Coordinator will provide an approval letter to the consultant allowing them to proceed with the work. Where there are minor deficiencies, the Quality Coordinator may provide conditional approval while dictating corrections in the plan, without requiring re-drafting of the documentation. These corrections will be considered part of the approved plan. Where there are major deficiencies, a comment letter will be drafted, indicating the plan deficiencies and suggesting corrections for re-drafting of the plan. Review and approval of the CAP by the NBP Program Coordinator shall be handled similarly.

7. Field Documentation

Though largely discussed elsewhere in this document, certain levels of field documentation will be required to be produced and maintained by the environmental consultant to help demonstrate compliance with approved methods and to assist reviewers to make QA conclusions. Examples of field documentation that will be a required element, as dictated by this QA Program Plan (Group B: Data Generation and Acquisition) or by an approved SAP or FSP, would include field logs, monitoring well sampling logs, and chain-of-custody forms for environmental samples. Field documentation will be included as part of the package to be submitted to independent data validation, along with the analytical laboratory data package. Field documentation will later be submitted as part of the assessment or cleanup report in a hard copy format.

8. Laboratory Analytical Package

The data package produced by the analytical laboratory should be sufficiently detailed to allow for review of analytical methods through data verification and validation processes in making conclusions about appropriateness of data quality. The requirements for the specific content laboratory data packages will be discussed in other sections of this QA Program Plan. As part of the flow of documentation being discussed in this section, the laboratory package along with the field documentation will be transmitted to those groups hired to undertake independent data validation services, as required by the provisions of this QA Program Plan. The parties conducting the data validation will be required to be fully independent from the laboratory which produced the data. (Laboratories, however, generally verify the data they produce.) The laboratory analytical package will later be submitted as part of the final assessment or cleanup report in a condensed form in a hard copy format. A full version in an acceptable electronic format (electronic data deliverable, EDD) will also be collected as part of the assessment or cleanup report for submittal.

9. Validated Data Package

The quantitative data resulting from field sampling and laboratory analysis will undergo independent data verification/validation services as dictated by other sections of this QA Program Plan. The validated data, including any appropriate data qualifications, will be submitted to the environmental consultant for inclusion in the draft project assessment or cleanup report. The consultant will use the validated data in their formulation of site assessment and cleanup conclusions. The data validation report will be required to be submitted as part of the assessment or cleanup report in an electronic format

10. Draft Assessment and Cleanup Reports

All site information generated during the assessment or cleanup must be collected, tabulated, and considered in a final report generated by the environmental consultant to document the project. Before the report is finalized, a draft version must be submitted to the NBP Quality Coordinator or remediation case officer and the program applicant to allow for comments and consideration of the quality and format of presented data.

The format of the assessment or cleanup report will depend on the project goals established during initial scoping sessions. For Phase I and Phase II Environmental Site Assessments (ESAs), the format of the report will largely be dictated by the American Society for Testing and Materials (ASTM) standards for those documents. For site characterization and site cleanup projects, there is no definitive guidance or standard for report format. The NBP operates through a contract with three different environmental consultants, each of whom may have their own standards or preference for report formats; consequently, the final report will largely be presented in a manner dictated by the individual consultant. However, general requirements for the final report would be the textual documentation of all work/field activities, presentation of all environmental data in a tabular and/or spatial format, and a section where the consultant uses their professional judgment to make conclusions about the site data in consideration of project goals. Through review of the draft reports, the NBP Quality Coordinator or the NBP Program Coordinator will evaluate the acceptability of the presentation.

Supporting documentation relevant to data generation and data quality must be attached to the final report, either in a hard-copy or electronic format. Generally, all field documentation will need to be attached to the report in a hard-copy format. The laboratory data package and data validation report should be attached in an electronic format, with the exception of the request for analysis forms and the actual laboratory analytical sheets, which should be included in hard-copy format.

11. Report Comment Letter

If the NBP Quality or Program Coordinator requires revisions to the draft report, those revisions will be communicated to the consultant through the drafting of a comment letter. The comment letter will include both suggested and required revisions. It will be the responsibility of the NBP Program or Quality Coordinator to determine whether the conclusions made by the consultant in the report are supported by the data and whether the data are of sufficient quality and quantity to meet project objectives.

Where project objectives are not met, the NBP Program or Quality Coordinator may recommend that additional data be collected to fulfill any data gaps before the final report is issued. Otherwise, the consultant may make the appropriate revisions as outlined in comment letters submitted by the NDEP for the submittal of a final deliverable. In those instances where the draft report requires no revisions, the consultant will still be directed to resubmit a final version of the report.

12. Final Report

Application to the NBP constitutes a request for service to produce a site assessment/characterization report or to document a completed site cleanup. Therefore, the final output of a project will be the submittal of a final assessment or cleanup report to the NDEP, the program applicant, and the EPA Nevada Project Officer. Additional copies of the final report will be provided to the program applicant, as dictated by their needs.

13. Project Closeout, No Further Action letter

Project closeout from the NBP will be granted upon receipt of the approved final report. Closeout will be in the form of written correspondence to the environmental consultant, with copies of the correspondence to all project stakeholders. The closeout letter will acknowledge receipt of the approved final deliverable and will request the consultant submit any outstanding invoices for project work. Under the NBP, project closeout reflects the adequacy of the final deliverable, it does not constitute site closure under state cleanup regulations.

For most cleanup projects undertaken by the NBP, project closeout will not occur until site closure is achieved through the state cleanup program; therefore, a completed cleanup, as determined by the issuance of a "no-further action" letter by the remediation case officer, will serve as the trigger for project closeout.

## A5: Background and Problem Definition

The NBP provides environmental assessment and cleanup services to eligible applicants across the State who are involved in real property transactions or property reuse considerations at sites with potential environmental impacts from previous site operations. The sites specifically undergoing redevelopment or reuse through the NBP constitute a small subset of property transactions, and the services provided by this program and these transactions must be consistent within the realm of well-established real estate practices. It is the purpose of the NBP to help applicants, who have redevelopment or reuse projects that will provide benefits for the larger community, either through improving economic or quality of life conditions, navigate the established real estate process, especially when the transaction is complicated by perceived or suspected contamination on the property.

Environmental contamination on real property can complicate real estate transactions or reuse considerations because liability for site contamination and responsibility for site cleanup must be assessed and understood by all parties involved prior to the successful completion of any financial deal. The financial responsibility for a costly cleanup can be assessed on a number of different parties, including financial institutions. Because of this responsibility, many privately negotiated agreements will be entered into cautiously, and financing for development of environmentally compromised property can be difficult to obtain. Depending on market forces, the concerns regarding environmental conditions of a site may be handled with very little involvement by governmental entities, with redevelopment or reuse being accomplished solely based on the value of the property and the project being considered. Where these beneficial market factors are not present, the NBP is available to help assist the property transaction. The NBP performs these site-specific environmental assessments or cleanups.

Under normal circumstances in the State of Nevada, the NDEP as the primary regulatory agency governing environmental issues has very little direct involvement in the initial stages of property transaction. It is not until an environmental issue is confirmed and concentrations of contaminants are determined to exceed established regulatory levels that the NDEP becomes involved. The State of Nevada does not prescribe specific requirements for performing environmental assessments, except in the case of a known release of a reportable quantity of a regulated substance. Rather, the initial decision-making processes associated with real estate transactions at sites with suspected contamination are governed by the property owner, prospective purchaser, and lending institution's understanding of State and Federal liability structures.

Participants involved in real estate transactions rely on environmental data to make decisions to secure their interests and limit their potential for losses. Industry standards, driven by laws governing environmental liability, have been developed to help standardize this process. For the majority of sites in the State of Nevada where environmental concerns are present, the NDEP is the lead regulatory authority for cleanup oversight; therefore, determining liability under State law is of primary importance.

Under State environmental regulations, the responsibility for cleanup of contaminated property is nearly always assessed on the current property owner. The current property owner may have recourse through private litigation to seek action for cost recovery against previous

owners/operators who may have caused the contamination, but they have the ultimate responsibility to work with the NDEP to ensure that cleanups are conducted and completed appropriately. For this reason, a potential purchaser has an interest in determining that environmental issues are resolved prior to their assumption of that property. A lack of reliable assessment information may discourage a potential purchaser due to the risk of assuming an unknown environmental liability.

For various reasons, private or other public resources may not be available to property owners or prospective purchasers to perform sufficiently detailed environmental assessments that will provide enough comfort for a transaction to proceed. Additionally, property owners may not even have the wherewithal to develop initial property information to attract purchaser or developer interest. These situations serve to limit property reuse and, by extension, property cleanup—a situation that the NBP is intended to prevent. It is the ultimate goal of the NBP to provide environmental information of sufficient quality and quantity to allow property owners and potential purchasers to proceed with property transfer and cleanup. To this end, projects must use analytical laboratories that are certified by the State of Nevada (see Appendix A).

Environmental assessments, as developed in industry standards, are roughly divided into three stages, each of which may be performed by the NBP on behalf of an applicant: (1) initial investigations, (2) site-specific sample collection, and (3) remedy development/cost estimates. These correspond to the ASTM Phase I, Phase II, and Phase III ESAs. Each of these stages has specific goals and objectives tied to property transactions and the local, state, and federal regulations governing environmental liability. These stages of effort are roughly outlined in the following paragraphs; greater detail regarding the performance of these stages of investigations, in conformance with industry standards and program requirements, are contained in other sections of this QA Program Plan.

The first and most basic step in determining environmental conditions at a transaction site is the Phase I ESA, which had previously corresponded to "due diligence" requirements on purchasers of properties and now equates with federally adopted regulations requiring "all appropriate inquiry" to qualify for "bona-fide prospective purchaser" status under CERCLA. The purpose of a Phase I or an all-appropriate inquiry study is to describe environmental conditions at a site through an investigation of site documents, consideration of observable visual clues during site visits, and the collection of information regarding past site use. Results of a Phase I investigation are used to assess whether environmental contaminants may be present at the site at concentrations that would require a property owner to take action in accordance with environmental regulations. This conclusion is made conservatively using best professional judgment, and is based on consideration of the quality and sufficiency of existing information. A property transaction may proceed comfortably if there is no reason to believe contaminants are present; otherwise, suspected environmental contaminants need to be further investigated through the collection of site-specific environmental data.

The most reliable method of determining the presence or extent of environmental impacts on a piece of property is the generation of site-specific environmental data, through sample collection and field monitoring. Site-specific confirmation sampling and analysis are performed as part of a Phase II ESA. Guided by findings of the initial investigations, sampling and monitoring plans are developed to investigate areas of potential concern or areas where no source of reliable

information could be obtained. The purpose of the Phase II ESA is to minimize uncertainty associated with "recognized environmental conditions" identified in initial investigations. Although a Phase II ESA is primarily intended for confirming the presence or absence of contamination, the sampling can be quite extensive and may even include activities generally considered to be conducted under the third stage of site assessment.

Beyond confirmation of "recognized environmental conditions," property owners and prospective purchasers will want to know the extent of the contamination and how this translates into cleanup or site reuse costs. The amount of sampling necessary beyond that needed to confirm site conditions is dependent on the required level of certainty to be attached to a cleanup cost estimate. These environmental efforts can come under the aegis of several related documents, including a Phase III ESA, an Engineering Evaluation/Cost Assessment, or any other type of comprehensive site investigation. The objective of this stage of assessment is to place definable boundaries on costs and timelines for cleanup, based on detailed information concerning the magnitude and extent of contamination at a piece of property. In order to accurately estimate cleanup costs, it may also be necessary to fully understand the remedial alternatives available to conduct the cleanup. For this reason, a Phase III ESA may be directly tied to the preparation of site cleanup plans.

The NBP is capable of providing any of these environmental services to eligible applicants accepted into the program. Because the goal of the NBP is to promote the cleanup and reuse of sites, this program will normally only accept sites where there is comfort that land transaction and site re-use will be a likely result of the assessment efforts. In order to provide the most incentive to accomplish this goal, the NBP will likely perform assessment services at a site, while working with the stakeholder parties to ensure that sites can be directly entered into a cleanup program and site remediation can commence.

In addition to assessment services, the NBP can also provide cleanup services on eligible properties for projects that have a significant public component, defined as active ownership of the property by a local or county government or non-profit agency either for public use or for eventual transition to private ownership as determined by the land holding agency. Site cleanups occur through the state cleanup program collectively referred to as "corrective actions," which comprises consolidated environmental authorities from the CWA and RCRA.

The NBP operates through the use of environmental consultants retained by contract to perform these services. All data generated by these private firms at the direction of the NBP staff are collected in consideration of the program applicant's project needs. The NBP operates as an independent control on data quality as generated by its consultants. The end product of a Brownfields assessment is a document that is used by the site owner and prospective purchaser to define transaction conditions and determine site re-use options. At the completion of a Brownfields cleanup, certification and issuance of a "no further action" letter is the responsibility of the NBP Program Coordinator.

## A6: Program/Task Description

The NBP generates environmental data in support of real property transactions on behalf of program applicants. The type and quality of data are generally dictated by the needs of the

applicants. Generally, the NDEP, through the NBP, will provide contract services for performing Phase I and Phase II ESAs, which are defined by industry standards. Where applicants require greater technical assistance, the NBP may offer more comprehensive assessment services, including performing a Phase III ESA, providing accurate estimates of cleanup costs, or developing cleanup/remediation plans. In the case of an eligible applicant holding properties with potential community benefit, the NBP may provide site cleanup services and generate confirmation data at completion to demonstrate regulatory compliance with State of Nevada Bureau of Corrective Actions.

The NBP is driven entirely by applicant needs, so data collection is not dictated by a regular schedule. Rather, as applicants enter the program, individual project goals are defined, including the types of environmental measurements, deliverables, and reports that will be completed. Therefore, at the most functional level, this QA Program Plan has been developed to guide data collection associated with one-time events for the assessment and cleanup of participating sites.

Site assessments under the NBP will be performed within the established framework for real estate transactions operating in the State of Nevada. To satisfy these purposes, three types of assessment services may be conducted, though the most frequent will likely be a fully comprehensive site investigation:

- Phase I ESA—the collection and review of available information regarding a property, in satisfaction of "due diligence" or "all-appropriate inquiry" requirements, conducted prior to completion of a transaction in order to determine the presence or likely presence of environmental contaminants. These assessments shall be conducted in accordance with the ASTM E1527-05 standard.

- Phase II ESA—a focused site investigation conducted to confirm the presence or absence of environmental contaminants at a site, typically completed prior to a property transaction in order to assess environmental liability issues as part of property negotiations. These assessments will be conducted in accordance with the ASTM E1903 standard.

- Phase III ESA, Comprehensive Site Investigation, Cleanup Cost Estimate—an industry standard has not been developed for a comprehensive site investigation to determine the full nature and extent of environmental contaminants at a site. Where an applicant requests assistance in this regard, a site-specific scoping process will be used to guide the project. This QA Program Plan is primarily geared toward performing these comprehensive site assessments.

Site cleanups are conducted under the authorities of the State cleanup program contained in regulations (NAC 445A.226 to 445A.22755). The state cleanup program requires the submittal of a CAP to the NDEP, Bureau of Corrective Actions. The CAP must be reviewed and approved by an NBP Program Coordinator, prior to initiation of cleanup activities. The completion of the cleanup will be documented in a request for closure report containing all generated site data including confirmatory sampling and disposal manifests. The NBP Program Coordinator, acting as the case cleanup officer, determines the adequacy of completed cleanup in the issuance of a "no further action" letter.

The NBP decides when to undertake an assessment or cleanup project at the time of receipt of a completed application and in consideration of program funding. At the time of project acceptance, planning activities commence through a collaborative process involving all project stakeholders and directed by the NBP Program and Quality Coordinators. The primary responsibility of the NBP staff is to oversee and ensure that data of adequate quality and quantity are collected to satisfy project objectives, as defined in the project-specific DQOs. To assure that analytical data are of adequate quality, state-certified laboratories must be used, and the items relevant to data validation (see Section A4.2, items 7 through 10) must be addressed.

## A7: Quality Objectives and Criteria for Measurement Data

This section is broken into two parts, consistent with EPA Region 9 guidance for QA Program Plans. The first section documents regulatory action levels that are specific to the NDEP; these action levels serve as the driver for site assessments and cleanup. The second section discusses MQOs and data quality indicators (DQIs) under the NBP.

DQIs are the quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of information to the user. DQIs are measures of individual data characteristics (the quality attributes) that together are called "analytical data quality." The principal DQIs are precision, bias (accuracy), representativeness, comparability, completeness, and sensitivity (also known as the PARCCS parameters)

MQOs are the acceptance thresholds or goals for project data, usually based on the individual DQIs for each matrix and analyte group or analyte. MQOs are method-specific analytical parameters derived from project-specific DQOs. Like DQOs, MQOs can be quantitative or qualitative statements. MQOs specify what the level of performance should be, but not how it will be achieved by each laboratory.

### A7.1 Regulatory Action Levels

Services provided by the NBP are intended to help applicants satisfy environmental laws and regulations as established by the State of Nevada. These services are intended to help to reduce obstacles for property transfer, redevelopment, or reuse that can result from these regulations. For the purposes of the NBP, the only regulations determined to be relevant in establishing site action levels come from State law sources; the NBP does not accept projects or work on sites of such significant magnitude that they may come under federal CERCLA authorities, either through placement on the NPL or through a federal enforcement action.

Objectives of specific projects will be determined through initial scoping sessions held with the participation of all involved stakeholders and following EPA's DQO process (EPA 2006a). There are two firm areas in State law that will govern much of the project objective formulation. These two areas are (1) the release reporting regulations, which govern the initiation of a site cleanup project, and (2) the establishment of action levels specific to site media. These two topics are discussed below.

### A7.1.1 *NDEP Release Reporting Regulations*

The State Environmental Commission has adopted regulations that govern the reporting of releases of pollutants, contaminants, petroleum products, and hazardous substances. These regulations are contained in NAC 445A.345 to 445A.348.

The enabling authority for these regulations is contained in several statutes adopted by the Nevada Legislature. The Nevada Water Pollution Control Law (Nevada Revised Statutes [NRS] 445A.300 to 445A.730) required the Commission to adopt regulations governing the amount of waste that may be discharged into the waters of the State (NRS 445A.424) and requiring owners and operators of any source of discharge to waters of the State (including groundwater and surface water) to notify the NDEP (NRS 445A.600). State law governing the disposal of hazardous waste has designated the NDEP as the state agency responsible for overseeing (NRS 459.700) and has required the Commission to adopt regulations for hazardous waste management (NRS 459.485) that must be based on studies, guidelines, and regulations of the Federal Government (NRS 459.490).

These enabling authorities allowed the Commission to adopt reporting requirements that would be protective of state water resources and would also be consistent with federal hazardous waste requirements. The model for the State release reporting regulations comes from two federal sources: (1) hazardous substance reportable quantities contained in CERCLA and (2) petroleum product reportable quantities from RCRA Subchapter IX. The Commission also added state-specific requirements for those substances and situations not covered by these two federal sources.

For hazardous substances, the State of Nevada has adopted by reference the reportable quantities established in 40 Code of Federal Regulations (CFR) Part 302. NNAC 445.347 requires owners or operators of facilities where a release above these quantities has occurred to notify the NDEP with details of the event within one working day of the release. This regulation has been interpreted to include both current releases and the discovery of historic contamination. In the event of historic contamination, where the initial volume of release cannot usually be determined, any discovery of an impact to soil, groundwater, or surface water is generally a reportable event.

For petroleum products, the State of Nevada has adopted reportable quantities of 25 gallons or 3 cubic yards of impacted soil; these quantities were established by the Federal government as the reportable quantity of a underground storage tank (UST) overfill in 40 CFR 280.53. The reportable volume has been used by the NDEP to establish a reasonable quantity for all petroleum releases that must be reported regardless of source or circumstance. In addition to the reportable quantity for petroleum releases to soil or other land surfaces, any release to or discovery on or in groundwater or surface water is a reportable event (NAC 445A.347).

For those State-defined pollutants, contaminants, and hazardous wastes that are neither listed hazardous substances according to 40 CFR Part 302 nor classified as petroleum products, any release to the environment would constitute a reportable event. A “pollutant” as defined in NRS 445A.400 includes:

*Dredged soil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water.*

A "contaminant" as defined in NRS 445A.325 includes any physical, chemical, biological or radiological substance or matter that is added to water. A "hazardous waste" as defined in NRS 459.430 means any waste that poses a threat to human health, public safety, or the environment if not properly stored, transported, disposed, or otherwise managed. These three definitions give the NDEP a broad range of authority to require release notification for any material which is not specifically listed as a hazardous substance in 40 CFR Part 302.4.

The spill reporting regulations and associated reportable quantities have been developed to ensure that a release or the discovery of historic contamination that has the potential to negatively affect human health or the environment are immediately brought to the attention of the NDEP. Release notification is the trigger point for the Bureau of Corrective Actions to initiate its assessment and remediation authorities.

### A7.1.2 *Establishment of Media-Specific Action Levels*

The NDEP Bureau of Corrective Action has authority to require owners and operators to conduct corrective actions at the site of a release. A "corrective action" has been defined in NAC 445A.2262 as

*A permanent remedy that an owner or operator is required to take after a release of a hazardous substance, hazardous waste or a regulated substance to prevent the substance or waste from posing a threat or potential threat to public health or the environment.*

Therefore, a corrective action must be both permanent and protective of human health and the environment. The Bureau has the authority to require corrective action and to set action levels for both soil and groundwater, as discussed in the following subsections. Surface water is also discussed, but only briefly, because most Brownfields assessment and cleanup projects do not address surface water issues. A detailed site-specific SAP will be required for sites with surface water contamination.

Action Levels for Soils

Action levels for soils are established in NAC 445A.2272. Except for petroleum products, which have an established action level of 100 mg/kg in soil, the Bureau has no specified numeric action level for each hazardous substance, pollutant, or contaminant. Instead, a site-specific action level can be selected using one of three methods, depending on the constituent and exposure pathway. A site-specific action level for a hazardous substances, hazardous waste or regulated substance can be established using one of the following methods:

1. The background concentrations metals or other inorganic chemicals;

2. The concentration for that substance or waste listed in the Toxicity Characteristics Leaching Rule, 40 CFR Part 261.24, if the potential for human exposure or damage to the environment from contaminated surface water or ground water is the primary pathway of concern; or

3. An appropriate level of concentration that is based on the protection of public health and safety and the environment as determined through the used of the Integrated Risk Information System (IRIS) adopted by the EPA, to be used when inhalation, ingestion or dermal exposure is the primary pathway of concern or if an applicable concentration is not listed in the Toxicity Characteristics Leaching Rule.

The Bureau must select the most restrictive action level if more than one of these methods is applicable to the hazardous substance or waste, but in no instance shall the Bureau select an action level that is less than the background concentration for that chemical. Each of these methods relies on established Federal guidelines and studies for the development of site-specific action levels.

Generally, an owner or operator responsible for corrective action at the site of a hazardous substance release will allow the Bureau to establish an action level for that hazardous substance using values generated by the EPA Region 9 for its published preliminary remediation goals (PRGs). The Bureau can use the PRG values as a default action level for a hazardous substance because these values were computed in a manner consistent with the third method listed above for selecting an action level under state regulations.

Rather than using a default PRG (which relies on a number of conservative exposure assumptions) as an action level for a particular hazardous substance, an owner or operator may collect site-specific data for use in IRIS. By providing site-specific data, the owner or operator can eliminate some of the conservative assumptions used in the development of the PRGs and can develop an action level that better reflects site conditions, exposure pathways, and risk.

Site-specific data can also be collected to support an action level for petroleum products or hazardous substances developed through an ASTM Method E1739-95 Risk Based Corrective Action (RBCA) assessment (NAC 445A.22705). Under State regulations, an owner or operator can use the RBCA guidelines to develop a site-specific action level for soils only; this approach is not available for groundwater contamination.

Regardless of action levels, the Bureau has the authority to require corrective action in any instance where a release to soil is determined to have an actual or imminent impact on groundwater or is hazardous to public health and safety (NAC 445A.22715). This gives the Bureau authority to deal with issues that would otherwise not require action, but where sensitive populations or receptors could be threatened and immediate action would be prudent. These special circumstances can be determined on a site-specific basis through the initial scoping sessions and development of project DQOs.

Action Levels for Groundwater

Except in specific situations, the Bureau will require corrective action if the release of a hazardous substance, hazardous waste, or regulated substance contaminates groundwater in excess of the State-established action levels (NAC 445A.22725). An owner or operator may submit a request to the Bureau to waive the requirements for corrective actions in the following instances:

1) The groundwater contaminated by the release is not a source of drinking water and is not likely to be a source of drinking water because it is economically or technologically impractical to recover the water for drinking, either because of the depth, quality, or location of the water;

2) The concentration of total dissolved solids (TDS) in the groundwater is more than 10,000 milligrams per liter (mg/L) and the groundwater is not reasonably expected to be used as a source of drinking water; or

3) A study demonstrates that, based on a review of available technology and the prohibitive cost of the corrective action, it is not technically feasible to achieve the required remediation standard.

In practice, these exceptions are rarely granted by the Bureau, but they do provide some flexibility for the Bureau to make decisions that are informed by risk and cost factors.

Action levels for groundwater (NAC 445A.22735) are set through similar methods as those created for soil contamination. This includes a specific action level for petroleum products (1/2 inch of free floating product on the surface of an aquifer) and prescribed calculations for hazardous substances consistent with Federal studies and guidelines. The most common method for the establishment of a state action level for a hazardous substance is the use of the maximum contaminant level (MCL) established pursuant to the SDWA, 42 U.S.C. § 300f et seq. and 40 CFR Part 141. If no MCL has been established for a particular hazardous substance, hazardous waste, or regulated substance, the action level can be set as an appropriate concentration based on the protection of public health and safety and the environment as determined through the use of IRIS. If background concentrations of inorganic chemicals are greater than the MCLs or another established action levels for those chemicals, then the background concentration may be used as the appropriate action level.

The Bureau is also able to use these regulations to develop interim action guidelines for contaminants for which there is no established MCL. The establishment of an interim action level has been pursued for common fuel oxygenates, specifically methyl *tert*-butyl ether (MTBE). Because of the increasingly common presence of MTBE at response action sites and because no MCL has been established for MTBE, the NDEP undertook a process to develop a "default" interim action level for MTBE that could be used at any site in the State without the need to perform site-specific calculations. The only consideration to be made for each site is the proximity to "sensitive receptors." An action level of 20 micrograms per liter (µg/L) has been established for sites within 1,000 feet of a sensitive receptor; all other sites may use an action level of 200 µg/L. These numbers were based on the lower limit of the lifetime health advisory for consumption of water by an adult from the EPA Office of Water.

State regulations specifically list factors that the Bureau should consider in establishing groundwater action levels; these factors include the following:

1. *The presence of more than one hazardous substance, hazardous waste or regulated substance in the groundwater;*

2. *Any potential threat the contamination may pose to sensitive areas of the environment; and*

3. *Any other threat or potential threat to groundwater that is specifically related to the site.*

These factors allow the Bureau to establish action levels that will be protective of human health and the environment when dealing with multiple contaminants or in situations where special environmental conditions dictate that a more restrictive action level is warranted.

Action Levels for Surface Water

The Bureau of Corrective Actions, under its cleanup authorities, has the ability to require an owner or operator to take corrective action if the release of a hazardous substance, hazardous waste, or regulated substance contaminates surface water (NAC 445A.2275). However, in most instances, impacts to surface waters of the State are handled entirely by the Bureau of Water Pollution Control of the NDEP, where the state-delegated CWA programs reside.

The Bureau of Water Pollution Control operates under delegated CWA authorities and under statutes and regulations passed by the Nevada legislature. Their primary regulatory functions, relevant to response actions as discussed in this Baseline Assessment report, include issuing National Pollutant Discharge Elimination System (NPDES) permits, groundwater protection orders, and Underground Injection Control permits. They also have compliance and enforcement authorities for storm water systems and surface water bodies. Enforcement and permit authorities rely on surface water standards developed and adopted by the NDEP. Surface water discharges and cleanups performed at sites undertaken by the NBP will be conducted with full participation of the Bureau of Water Pollution Control for the selection of appropriate standards, permitting of discharges, and selection of remedial actions. These standards and appropriate sampling methods for surface water must be detailed in a site-specific SAP.

### *A7.1.3 Summary of Regulatory Action Levels*

The NDEP has few chemical-specific action levels, so no guiding table has been prepared to accompany this QA Program Plan. Rather, the process listed in regulation for establishing site-specific action levels can vary based on site conditions and offers a wide variety of methods to the regulated community to select an appropriate level. For this reason, data quality considerations will rely on site-specific planning using EPA's DQO process prior to initiation of data collection. As part of the DQO process, consideration of these regulatory methods will be made to determine which approach would best suit the goals of the property owner or program participant. Because the NDEP and EPA will be involved in these initial discussions, an appropriate regulatory framework will be developed that can guide data collection for each site. The Brownfields environmental consultants will be responsible for documenting all steps of the DQO process and the decisions reached in their site-specific SAP or FSP.

## A7.2 Measurement Quality Objectives and Data Quality Indicators

MQOs are the acceptance thresholds or goals for this project's data, usually based on the individual DQIs for each matrix and analyte group or analyte. To ensure that data of adequate

quality are generated, the NBP has adopted QC acceptance criteria for DQIs for specific analytes, as developed by the EPA Region 9. For some projects, criteria can be presented in a table, such as that illustrated at the end of this document, for typical chemistry data.

MQOs are qualitative and quantitative statements developed by data users to specify the quality of data needed to support specific decisions and are defined in terms of acceptance criteria for certain DQIs. These MQOs provide project-specific limits for precision, accuracy, representativeness, completeness, and comparability parameters. Precision and accuracy are defined on a method- and analyte-specific basis. The MQOs also describe specific targets for sample holding times, sample preservation, detection limits, equipment calibration frequencies, and other QC elements. EPA guidance establishes acceptance limits for method blanks, matrix spikes, surrogate spikes, and laboratory control samples. These adopted criteria will serve as the foundation for the review of laboratory generated data by independent data validation services and by the NBP Quality Coordinator. Data that meet these quality criteria can be used to justify decisions on the basis of regulatory action levels previously described.

The MQOs and DQIs specifically adopted in this QA Program Plan and presented in Appendix D, include only those analyses that are anticipated during a routine Brownfields assessment or cleanup. These include:

- Total Dissolved Solids (TDS) by EPA Method 160.1
- Total Suspended Solids (TSS) by EPA Method 160.2
- Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP) by EPA Method 200.7
- Carbonate, Bicarbonate, and Total Alkalinity by Standard Method 2320
- Total Petroleum Hydrocarbons (TPH) by SW-846 Method 8015B
- Volatile Organic Compounds (VOCs) by SW-846 Method 8260
- Semivolatile Organic Compounds (SVOCs) by SW-846 Method 8270
- Polynuclear Aromatic Hydrocarbons (PAHs) by SW-846 Method 8310
- Toxicity Characteristic Leaching Procedure (TCLP) for VOCs, SVOCs, and Metals by SW-846 Method 1311

These analyses cover the majority of sites in the NBP and serve as the basis for the development and adoption of approved SOPs and Analytical Methods in Group B of this QA Program Plan. Any assessment or cleanup project involving only these constituents can be undertaken through the drafting of an FSP during the project planning phase of work.

A site-specific SAP will be required to be drafted in cases of unusual media, analytes, or analyses, where there are no adopted MQOs included in this QA Program Plan. Where available, the Brownfields environmental consultant may use and include in their SAP any MQO

adopted by EPA Region 9. Otherwise, acceptance criteria for DQIs will need to be developed as part of the project planning phase and appropriately documented. Where it is anticipated that a project will involve a constituent or media for which EPA Region 9 has not developed acceptance criteria for DQIs, the participation by a EPA QA Officer will be a mandatory element of project planning, and the EPA QA Officer will reserve the right to review the consultant's SAP before the data are collected.

It is the responsibility of the NBP Quality Coordinator to ensure that the latest versions of the adopted MQOs are included in this QA Program Plan and are referenced by the consultants in their plans. This function will be completed in conjunction with the YSA. Changes made to the MQOs will require revision to the QA Program Plan and the revised information will be provided to all relevant parties, as indicated by the document distribution list.

As part of the development of an FSP or SAP, the environmental consultant will be required to present the project MQOs to those analytical laboratories intended to analyze the collected field samples. Those laboratories will be required to meet these criteria and supply a data package sufficient to document those QC elements. If the laboratory is unable to satisfy these requirements, alternate laboratory services must be sought out and selected by the environmental consultant. Under certain conditions, deviations by the laboratory to the MQOs on a project-specific basis can be considered, but those deviations must be included in a SAP for approval by the NBP Quality Coordinator prior to project initiation.

For all projects involving laboratory analytical services, the laboratory will be required to submit a data package of sufficient documentation to allow for review by independent validation services. This documentation will be equivalent to a Level 3 Data Package for all samples. All independent data validation services will be provided with the MQOs and DQIs for all analytes for consideration of data verification and with guidelines to establish appropriate data qualifiers.

## A8: Special Training/Certification

Statewide training policy directs that each Department of the Executive Branch of Nevada's government must develop training procedures that will provide for orientation and on-the-job training as well as the continued training and development of each employee within the agency. The Department of Conservation and Natural Resources has published its Formal Training Policy in a memo dated July 14, 1992. This memo has been made available to all employees.

It is the responsibility of employees to improve their own professional competence by freely requesting training opportunities. Employees must identify training requests by showing the relationship of the training to their job and by showing the benefits to the agency. Additionally, employees must take training required by the agency. Employees must show satisfactory completion of all approved training.

### A8.1 Brownfields and QA-Specific Training

In addition to the general training procedures established by the State of Nevada, the NBP will set forth program-specific training requirements targeted specifically to developing and maintaining an appropriate skill level in the Quality Coordinator position.

The NBP Quality Coordinator should receive training equivalent to that required for EPA QA Officers, to include participation in the week-long introductory course on quality assurance offered by the EPA, when available. Where no reasonable date for this training is available, the Quality Coordinator will be required to work through the training course and materials on-line at http://www.epa.gov/quality/trcourse.html prior to initiation of any quality assurance work. The on-line training should only serve as a temporary substitute to the classroom training, and every effort should be made to identify and attend appropriate EPA-sponsored coursework.

In addition to the initial week-long (or equivalent) training, the Quality Coordinator should be responsible for attendance at a minimum of 2 days of QA-specific training every year after completion of initial training. These additional training opportunities can be identified by the Quality Coordinator, the NBP Supervisor, the EPA Nevada Project Officer, or an EPA QA Officer. The training requirement can be satisfied either by coursework or by participation in QA conferences. The satisfaction of training requirements must be documented in the YSA.

The Quality Coordinator is also responsible for identifying any mandatory training to be attended by the three statewide NBP contractors. Although these consultants are responsible for maintaining an appropriate level of professional experience through their own initiative, certain training opportunities may be found necessary by the Quality Coordinator for the proper operation of the NBP. These may include quality assurance training sessions, covering the relevant aspects of the NBP QA Program Plan, to be hosted by the NDEP. Training for using the QA Program Plan may be held whenever a new consultant firm or staff becomes involved with the NBP. Reimbursement through the Brownfields contract for consultant training will only be considered for mandated training sessions and at the discretion of the NBP Quality Coordinator; consultants will be responsible financially for all other professional development necessary for their operation in the NBP.

### *A8.1.1 Employee Evaluations*

Employee evaluations are required to be prepared by supervisory staff once per year and are designed to establish, among other things, a constructive dialog between the employee and their supervisor with regard to work performance. In order to ensure objectivity and accuracy of employee evaluations, it shall be the policy of the NDEP that all substandard evaluations and all above standard and outstanding evaluations be prepared by the employee's supervisor and reviewed by the next line supervisor for concurrence. This review shall be conducted on draft evaluations and prior to release or discussions of the final evaluation with the employee. Supervisors are encouraged but not required to discuss standard evaluations with upper-level supervisors as well.

Evaluations are prepared based off of previously agreed upon work performance standards. Work performance standards are written statements of principal assignments, responsibilities, and the results expected by both the supervisor and employee when the employee's job is satisfactorily performed under existing working conditions. It is required that each employee in classified State service be provided with a current set of work performance standards for their position.

### *A8.1.2 Consultant Certification*

The NDEP operates a program for the certification of Environmental Managers. Any person performing environmental services for a fee must meet the certification qualifications and be actively enrolled as a CEM. The Certification Program is undertaken by the Bureau of Corrective Actions, separately from the NBP; however, all work submitted by the statewide Brownfields Consultants must satisfy the certification requirements as contained in regulations NAC 459.970 to 459.9729.

Certification as a CEM requires three components: qualifications, examination, and application. To qualify for application into the program an individual must meet minimum qualifications as established in one of three ways:

1. A bachelor's or advanced degree from an accredited college or university in an area relating to the environment including, but not limited to, environmental science, engineering, geology, hydrology, hydrogeology, biology, toxicology, environmental health, physics, industrial hygiene or chemistry and at least 3 years of relevant environmental experience within the 5 years immediately preceding the date of the application;

2. A relevant professional registration or certification recognized by the Division and at least 3 years of relevant environmental experience within the 5 years immediately preceding the date of the application; or

3. An equivalent combination of appropriate education or experience, or both, as determined by the Division.

By meeting these qualifications, an individual may then seek certification by passing an examination, as administered by the NDEP, to demonstrate a sufficient knowledge of current environmental practices.

All environmental work, relating to services for which certification is required, must include a jurat or affidavit by the person responsible for the work as specified in regulations. The jurat is intended to clearly delineate who is in responsible control of the work conducted by the consultant, the level of care utilized, the scope of services performed, and the individual's certification number and expiration date. The certification laws and regulations allow for non-certified individuals to conduct activities at a site without the presence of someone certified; however, the overall work activities must be performed within the responsible control and oversight of a certified individual. The format of the certification jurat is as follows:

> *"I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state and local statutes, regulations and ordinances."*

The jurat must be accompanied by a description of the services provided, the signature of the holder of the certificate with the date on which the document was signed, the number of the certificate, and the date of expiration of the certificate.

All documents prepared and submitted by the statewide NBP contractors must be overseen by a CEM. All documents must include the appropriate jurat in order to be accepted as a deliverable under the contract. The contracted consultants will be responsible for ensuring the availability of a CEM for work services throughout the life of the contract.

### A9: Documents and Records

The NDEP has adopted by reference the General Records Retention Schedule, dated November 15, 1995, as prepared by the Nevada State Records Committee for the distribution, retention, access, preservation, and disposition of official state records. Official state records are defined as all papers, unpublished books, maps, photographs, machine readable materials, or other documentary materials regardless of physical form or characteristics, made or received by an agency of the state government under state law or in connection with the transaction of public business and preserved, or appropriate for preservation, by that agency or its legitimate successor as evidence of the organization, function, policies, decisions, procedures, operations, or other activities of the state government or because of the informational value of data in them.

The Records Management Section of the Nevada State Library and Archives are responsible for promulgating the General Records Retention Schedule which is binding for the Executive Branch of Nevada State Government. An approved records retention schedule identifies each record series in the legal custody of an agency and refers to the Records Disposition Authorization which is approved by the State Records Committee. All official records stored off-site will be stored in facilities that meet the provisions of the *State Administrative Manual: 2026*, to the extent that qualifying space is available, affordable, and conveniently located to Division offices. All official state records, either paper or electronic versions, will be disposed of in accordance with the General Records Retention Schedule. Official state records will not be destroyed without an approved Records Retention Schedule on file with the State Library and Archives.

### A9.1 Records for the Nevada Brownfields Program

The NDEP has identified two records series which, due to specific federal regulations, require retention schedules beyond those contained in the State's General Records Retention Schedule. One of these schedules governs the retention of documents relating to programs operating under a CERCLA (or "Superfund") cooperative agreement with the EPA. The NBP operates under a CERCLA cooperative agreement, so all documents will follow the retention schedule developed in accordance with the CERCLA federal regulations 40CFR35.6700 and 40CFR35.6705.

The Superfund records series is defined in an Inventory Worksheet Form reviewed and approved by the States Records Manager. It identifies financial, program, and specific site activities records, correspondence, supporting documents, statistical records, and other documentation required relevant to Superfund (CERCLA-funded) cooperative agreements. These documents are to be maintained as public records in accordance with citation NRS 239.010: all public books

and public records of a governmental entity, the contents of which are not otherwise declared by law to be confidential, must be open at all times during office hours to inspection by any person, and may be fully copied or an abstract or memorandum may be prepared from those public books and public records; a person may request a copy of a public record in any medium in which the public record is readily available; an officer, employee or agent of a governmental entity who has custody of a public record shall not refuse to provide a copy of that public record in a readily available medium because he has already prepared or would prefer to provide the copy in a different medium.

The Records Disposition Authorization (RDA) form for Superfund records was submitted to and approved by the State Records Committee. The RDA governs how a document will retained and disposed of after the required retention period. Superfund documents have been assigned an RDA code of 95-038 and are required to be retained for a minimum period of ten calendar years following submission of the final Financial Status Report unless otherwise directed by the EPA award official. Written approval must be obtained from the EPA award official before destroying any records. If any litigation, claim, negotiation, audit, cost recovery, or other action involving the records has started before the expiration of the ten-year period, the records must be retained until completion of the action and the resolution of all the issues which arise from it.

The NDEP has entered into an Interlocal Agreement with the Department of Administration, Internal Audit and Purchasing Divisions for the retention of Superfund documents. The terms of the agreement state that NDEP will clearly mark each relevant document as "SUPERFUND OR BROWNFIELDS SITE, must be filed separately." The Department of Administration, Internal Audit and Purchasing Division will file separately all original Superfund or Brownfields documents, and after the normal retention period expires, the documents will be forwarded to NDEP. The NDEP will be responsible for maintaining the originals for the remainder of the ten-year retention period.

### A9.2 Responsibilities

The Administrator of the NDEP must make, receive, and preserve records containing adequate and proper documentation of the organization, functions, policies, decisions, procedures, and essential transactions of the agency. Prior to the creation of electronic records, the Administrator must consult with the Department of Information Technology on the implementation of its strategic plan for information resources and information technology, the purchase and implementation of hardware and software, and the establishment of security and training programs. He/she must also work with the State Records Management program to ensure the proper use, maintenance, retention, preservation, and disposal of electronic records.

The Administrator must establish and be responsible and accountable for the implementation of written safeguards against the unlawful removal, misuse, damage, alteration, destruction or loss of records. He/she must inform the Attorney General of any actual, impending, or threatened unlawful act regarding records in the legal custody of the agency. The Administrator shall take all measures possible to protect the records in the agency's legal custody from a natural or other disaster. He/she shall be responsible and held accountable to procure the proper supplies, equipment, and personnel to protect the records in the agency's custody. If any damage comes to the records, this must be reported to the Assistant Administrator for Archives and Records.

In compliance with the *State Administrative Manual: 2018*, the Division has designated Administration's Management Assistant IV as the Records Management Officer. All questions, request for information, requests to make changes to retention schedules, or requests for extraordinary retention schedules shall be coordinated through this position.

It is the responsibility of each NDEP employee to ensure that either a paper or electronic copy of all public records generated and/or signed by them are retained in the Bureau's files in accordance to procedures. It is also the responsibility of each employee to back-up any electronic data files generated by them including memos, letters, and directives created and sent by e-mail.

It is the responsibility of the Division's Bureau of Environmental Information and Planning to backup the Cash Receipts database on a no less than daily basis (this information is also backed up by transferring the information onto the file server located at 901 South Stewart Street), backup the remainder of the system on a weekly basis (starts at Midnight every Friday), and transfer the monthly tape-backup (contains all electronic files saved to the Local Area Network) to the main Office of Fiscal and Personnel Management safe (2-hour fire protection) no later than five days after the end of the month.

The staff providing direct NDEP oversight on a project is responsible for assuring that field and analytical records are in the project file. A unique, seven-digit alpha-numeric identification code will be assigned for each investigation or project, known as the Facility ID. Custody tags, custody records, field notes, and analytical records are labeled with this code. Each record is required to have the project number, date, and an agency person's initials or signature.

### A9.3 Project Files for Nevada Brownfields Program Sites

Although the NBP undertakes a variety of unique projects, most of the documents in a project file and the contents of the file itself will be fairly standard. The NBP Program Coordinator will be responsible for the maintenance of the project file, from the opening of an assessment or cleanup case to its eventual closing. The project file will be referenced by the seven-digit Facility ID number, assigned at the time of acceptance of the site into the NBP. When closure has been granted by the NBP Program Coordinator on a Brownfields cleanup, the separate files maintained by the NBP Program Coordinator and the NBP Quality Coordinator will be merged for archival filing. The merging of the files will be the responsibility of the NBP Program Coordinator.

The project file will consist of all site documents specifically listed in Section A4.2 of this QA Program Plan. Additionally, the NBP Quality Coordinator will collect and include in the project file all other relevant project documentation in the file. These additional documents may include any official correspondence that does not correspond to any of those previously listed documents. The project file will also include all information not related to data generation, including documentation of all public involvement or community notification efforts.

Project-specific accounting information, excluding site-specific SOWs and SOW approval letters, will not be maintained in the project file. Invoices, invoice tracking, and payment information will be maintained in a separate contract file associated with all contract specific

functions. Certain documents, including the SOW, SOW approval letter, and project closeout letter will be maintained as an original in the project file with a carbon copy to the contract file for completeness of each separate file. The contract file will be subject to the same records retention schedule as the project file. It is the responsibility of the Superfund and Brownfields Branch supervisor to ensure that this file is properly created and retained.

Electronic information relevant to the project will be maintained on NDEP's Local Area Network. An electronic folder will be created with reference to the assigned seven digit Facility ID number and will be maintained in the Bureau of Corrective Action's facility directory. However, hard-copy versions of all electronic documents will be required to be printed out and included in the project file for archival purposes. It is the responsibility of the NDEP's Bureau of Environmental Planning and Information to provide secure access to electronic information and to maintain appropriate back-up procedures for recovery of any lost information. The functioning of the Bureau of Environmental Planning and Information is laid out in policies required to be reviewed by all NDEP employees. These policies are also available to any other party who may wish to familiarize themselves with the NDEP informational security and backup capabilities.

## GROUP B: DATA GENERATION AND ACQUISITION ELEMENTS

### B1: Sampling Process Design (Experimental Design)

Brownfields site assessments are conducted to facilitate the reuse of properties by determining if site media are contaminated. If the initial phase of the assessment finds evidence of contamination, then follow-on phases are conducted to determine characteristics of the contamination. Characterization includes evaluating the threat posed by the contamination, determining potential solutions for cleanup of the contamination, and estimating the cost of solutions necessary to prepare the site for redevelopment. This QA Program Plan documents the planning, implementation, and assessment procedures for the NBP and describes how specific QA and QC activities are applied throughout the course of the site investigations.

A Brownfields site assessment routinely involves one or more of the following activities: a background investigation on the history of site use, a field investigation that includes sample collection and analysis, an evaluation of cleanup options and costs, and an assessment of the usability of resulting data. Typically, the first step is to conduct an investigation of site history to identify past uses of the property, including types and amounts of chemicals that may have been used onsite and any disposal activities that may have contributed to contamination.

This QA Program Plan includes requirements for measurements collected for a typical Brownfields project (Table B1) and describes what types of activities or projects specifically require a SAP and what types require an FSP. The specific design and extent of a Brownfields site assessment will be dictated largely by the conceptual site model (CSM), the availability of resources, and the required level of data quality and QC. Project-specific DQOs and sampling design should be documented in the site-specific planning documents that are developed for each Brownfields site.

The following sections describe the sampling and analysis requirements under the NBP. Site-specific information required in the FSP or SAP for each Brownfields site includes the number and location of monitoring samples, types of samples to be collected, measurement parameters, sampling frequencies, design of sampling networks for monitoring, and the time period over which sampling activities are to occur. All SAPs and FSPs prepared for the NBP must be reviewed and approved by the NBP Program and Quality Coordinators.

#### B1.1 Sampling Design

A sampling design specifies the number and location of samples to be collected at a site. Sampling design strategies are guided by study objectives and should factor in the conditions unique to the site being considered for redevelopment, including data gaps in the CSM, exposure potential, projected site reuse, and available resources. As noted above, possible sampling design strategies are identified during the DQO process, and the details of the sampling design strategy are described in the site-specific SAP or FSP.

Typical designs for the collection of samples at Brownfields sites include biased sampling, statistically based sampling, one-time events, and ongoing (multi-phase) events. Biased sampling specifies sampling locations based on the judgment of the field team leader and sampling plan designer. Statistically based sampling designs use random or systematic sampling

locations designed to avoid bias. A single sampling event may not provide an adequate characterization of the contamination onsite, especially when the CSM contains significant data gaps. In these situations multi-phase sampling may be helpful. The need for this sort of investigation should be identified during the DQO process.

Additional information on the development of sampling strategies is available in EPA's Quality Assurance Guidance for Conducting Brownfields Site Assessments (EPA 1998), EPA's Guidance on Choosing a Sampling Design for Environmental Data Collection (EPA 2002), EPA's Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA 2006a), and EPA's Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (November 2001). Visual sample plan (VSP) can be used to assist with statistically based sampling designs. The VSP software is free and available at http://dqo.pnl.gov/; version 4.4 of VSP was released February 21, 2006. VSP is a software tool for selecting the number and location of environmental samples so that statistical tests performed on the data have the required confidence and power for decision making.

### *B1.1.1 Sample Types and Matrices*

Sample types typically include surface soil, subsurface soil, groundwater, and surface water. Some sites require sampling of sediment, pore water, sludge, air (soil gas or vapors), and other non-routine matrices such as building materials. Samples may be collected as discrete (grab) or composite samples. Discrete samples are useful for identifying and quantifying chemicals in areas of a site where contamination is suspected. The number of discrete samples should be determined during the DQO process. Composite samples are useful for identifying the average concentrations of contaminants across a site. Composite samples are composed of more than one discrete sample collected from different locations; the samples are mixed into a single homogeneous sample and submitted to the analytical laboratory as a single sample. The number of composite samples and the number of individual samples within a composite sample should be based on the goals established during the DQO process.

Background samples should be collected from the same media as site samples, from areas on or near the site that are unlikely to be impacted by site contamination. Background samples are analyzed for the same parameters as the site samples to establish background concentrations of chemicals. Typically, background data are collected for naturally occurring inorganic chemicals, such as metals, whereas the background concentrations of manmade organic chemicals are assumed to be zero. It would be the responsibility of the applicant to demonstrate if there is an "anthropogenic background" for organic chemicals that is unrelated to site activities.

### *B1.1.2 Sampling Locations and Frequencies*

The sampling locations and the schedule for sampling are also specified during the DQO planning process. The duration over which samples are collected and the frequency of sampling or whether the work will be done in phases is also determined during the DQO process.

### *B1.1.3 Parameters of Interest*

The measurements to be collected at a site depend on the characteristics and history of the site. This QA Program Plan provides QA/QC information for parameters and media typically

analyzed for Brownfields sites. Unusual parameters and matrices will necessitate preparation of a site-specific SAP. This topic is discussed in more detail in Section B2 of this QA Program Plan.

### *B1.1.4 Sampling Event Planning*

Advance planning for field sampling events is required to ensure that the necessary arrangements are in place and that equipment is ready. The following will be considered when planning the sampling event:

1) Sample Handling and Custody Procedures — Field personnel will make arrangements with the appropriate laboratory for proper sample containers and custody procedures (described further in Section B3).

2) Equipment — Field personnel will ensure that all sampling equipment has been properly assembled, decontaminated, calibrated, and is functioning properly prior to use. Equipment will be used according to manufacturer's instructions, and should generally be decontaminated according to the EPA SOP-Sampling Equipment Decontamination (see Appendix E of this QA Program Plan).

3) Field Forms — Field personnel will need to ensure that all necessary field forms, such field log books, soil and groundwater sampling forms, and boring logs are assembled prior to the sampling event. Such field forms will be developed individually for each site based on the site's specific needs.

4) Health and Safety — Field personnel will ensure that a site-specific health and safety procedures are considered, and that personal protective equipment (PPE) is gathered.

5) Investigation-Derived Waste — Field personnel will plan for the generation of investigation-derived waste (IDW), and should assemble the appropriate IDW containers prior to the sampling event.

6) Field Audits — Field personnel will plan to conduct periodic field system audits for ongoing sampling events.

7) Paperwork and Permits — Field personnel will also ensure prior to the sampling event that other applicable paperwork is in order, such as permits and access agreements.

## B2: Sampling Methods

Site-specific sampling methods and types of samples are specified during the DQO process and documented in the site-specific SAP or FSP. Details of sample collection methods will depend upon site conditions, equipment limitations, contaminants of concern, sample matrices, and cost, and will be described in a site-specific SAP or FSP. Collection methods should generally follow an NDEP or EPA-approved sampling protocol. The following sections present general information on sampling methods for various media, including surface water, groundwater, drinking water, soil, sediment, pore water, sludge, air, and non-routine matrices, such as building materials. Additional methods may be used with approval of the NBP Program or

Quality Coordinator. General field sampling guidelines are included in the EPA SOP on General Field Sampling Guidelines. EPA SOPs for field sampling methods are available for download at http://www.ert.org/mainContent.asp?section=Products&subsection=List

### B2.1 Soil Samples

Soil samples are typically collected at Brownfields sites and may include surface and subsurface samples. Sample types may be discrete or composite samples. There are a variety of acceptable methods for collection of soil samples, and selection of an appropriate method will depend on site conditions. Methods commonly used to collect soil samples include drilling soil borings, digging test pits, sampling via hand auger, and digging with a shovel or trowel. Additional information on the collection of soil samples can be found in EPA's Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies (1992) and in the referenced EPA SOP for soil sampling (see Appendix E of this QA Program Plan).

### B2.2 Groundwater Samples

Samples of groundwater are typically collected during Brownfields site assessments and cleanups. Collection of groundwater samples may be one-time, ongoing and periodic, or may continue as part of the post-development obligations. Groundwater samples can be collected from soil borings, temporary well points, monitoring wells, existing wells (e.g., municipal or community supply wells, domestic water wells, irrigation wells, or industrial supply wells). Groundwater samples may also be collected from shallow, intermediate, deep, and perched aquifers.

Groundwater samples collected using soil borings allow for the collection of one-time discrete groundwater samples at a specific depth interval at a point in time. One-time groundwater samples are often used to help select locations for future monitoring wells. These one-time samples are often collected using a direct-push method, which is described in the SOP for direct-push groundwater sampling (see Appendix E of this QA Program Plan).

Groundwater samples may also be collected from permanently installed monitoring wells. All monitoring wells should be properly installed and developed according to an NDEP or EPA-approved protocol. Nonstandard wells or problems encountered during well installation and sampling should be noted in the field logbook and in subsequent reports. Collection of groundwater samples from monitoring wells is described in the EPA SOPs for groundwater well sampling, monitoring well installation, and monitoring well development (see Appendix E of this QA Program Plan).

The following procedures should be employed when sampling residential water supplies or water-supply wells of any kind:

- Obtain permission to access property and obtain samples for analysis
- Inspect the water system to locate the tap nearest to the wellhead. Samples should be collected prior to any treatment units (UV, reverse osmosis, etc.) if possible.

- Purge the water lines to flush the plumbing and holding tanks before collecting samples from drinking water, irrigation, or industrial wells, so that the sample collected is as representative as possible. Remove any faucet aerators and reduce water flow before collecting samples.

### B2.3 Surface Water Samples

Surface water sampling may be conducted during Brownfields site assessments and cleanups to evaluate whether contaminants have migrated to nearby surface water bodies. Physical evidence such as odors, organic films on water surfaces, and soil discoloration in the vicinity of surface water are indicators of possible contamination. Surface water samples include representative liquid samples collected from streams, brooks, rivers, lakes, ponds, lagoons, seeps, estuaries, drainage ways, sewers, channels, wetlands, surface water impoundments, and other surface water bodies. These samples can also be collected from the surface or at depth. Surface water samples should be collected in general accordance with the EPA SOP for surface water sampling (see Appendix E of this QA Program Plan).

### B2.4 Pore Water Samples

Pore water is water contained within the upper few centimeters of sediments just below the surface water / sediment interface. This interface is known as the hyporheic zone. Sampling of this zone can be done with equipment such as seepage meters and push-point pore water samplers. Discharge of groundwater to surface water through the hyporheic zone is unlikely to be homogeneous; therefore, determining locations for sampling can involve additional investigative steps.

### B2.5 Sediment Samples

Sediment samples can be collected for analysis of biological, chemical, or physical parameters. There are many factors to consider when choosing sediment sampling equipment, including, but not limited to, site access, sample volume requirements, sediment texture, target depth for sediment collection, and flowing versus standing water. In general, piston samplers are best used for soft, fine-grained sediments where sediments at depth are required. Grab/dredge samplers are best for coarse, shallow sediments and where large volumes of sediment are required. Additional information on the collection of sediment samples is provided in EPA's SOP for sediment sampling (see Appendix E of this QA Program Plan).

### B2.5 Sludge Samples

Sampling of sludge could involve a number of different situations and will likely depend upon site conditions. Therefore, details of collecting sludge samples should be described in a site-specific SAP. Common settings where sludge is sampled include catch basins and drywells.

### B2.6 Air Samples

Air sampling is typically conducted at sites where vapor intrusion may be an exposure pathway for contaminants. Air sampling is more complex than soil or water sampling because of the reactivity of chemical compounds in the gas matrix and sample interaction with the sampling

equipment and media. Air sampling equipment is selected based on a number of factors including site conditions, sampling objectives, contaminants of concern, analytical methods, and cost. Methods to sample air at active facilities include (but are not limited to) soil gas sampling or sampling with flux chambers. Typical sampling containers include tedlar bags, stainless steel Summa canisters, and glass sorbent traps used with sampling pumps. More information on air sampling and analysis can be found at: http://www.airtoxics.com/ and in EPA's SOP for general air sampling guidelines (see Appendix E of this QA Program Plan).

### B2.7 Building Materials Samples

Because sampling at Brownfields sites can often involve buildings slated for reuse, there is a potential for non-routine sampling of unusual sample matrices, such as building materials. These matrices include lead-based paint, asbestos-containing materials, and other types of building materials. Site-specific sample collection procedures will likely need to be developed for sampling such non-routine matrices. Sampling personnel should coordinate with the analytical laboratory on the anticipated sample collection and handling methods to ensure that the sample data will not be rejected. Additional information on the collection of non-routine sample matrices is in EPA's SOP for chip, wipe, and sweep sampling (see Appendix E of this QA Program Plan).

## B3: Sample Handling and Custody

Custody procedures differ among laboratories. Custody procedures of the analyzing laboratory are identified prior to field activities. Field personnel must make arrangements with the appropriate laboratory for proper sample containers, preservatives, holding times, and sampling request forms. Sample custody must be traceable from the time of sample collection until results are reported. Sample custody procedures provide a mechanism for documenting information related to sample collection and handling. A chain-of-custody form must be completed after sample collection and prior to sample shipment or release. The chain-of-custody form, sample labels, and field documentation must be crossed checked to verify sample identification, type of analyses, number of containers, sample volume, preservatives and type of containers. Additional information on sample handing and custody procedures can be found in EPA SOPs for specific sample collection methods, Section 4 of EPA's Quality Assurance Guidance for Conducting Brownfields Site Assessments (EPA 1998), and in Section 3 of EPA's Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (2001). SOPs and forms for sample handling, custody (chain-of-custody forms), and transport are referenced in Appendix E of this QA Program Plan.

The following sample control activities must be conducted at the laboratory:

- Initial sample login and verification of samples received with the chain-of-custody form;
- Document any discrepancies noted during login on the chain of custody;
- Initiate internal laboratory custody procedure;

- Verify sample preservation (e.g., temperature);
- Notify the project coordinator if any problems or discrepancies are identified; and
- Proper samples storage, including daily refrigerator temperature monitoring and sample security.

## B4: Analytical Methods

All analytical methods used for samples from Brownfields site assessments must comply with relevant requirements of applicable federal or state programs for which they were collected, such as the CWA, SDWA, RCRA, Clean Air Act, or use other EPA-approved alternate methods. The most recently approved methods under the CWA and SDWA were promulgated in 40 CFR Part 136 on July 21, 2003. Currently approved methods under RCRA SW-846 can be obtained from the EPA website at http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm Because the list of approved analytical methods is subject to routine update, contact the NDEP Project Manager for a list of currently approved methods.

Appendix F lists all the currently approved methods under RCRA SW-846. Table B1 lists the classes of analytes that are typically of the greatest interest during Brownfields site assessments, as well as the NDEP's preferred analytical methods. This table provides a starting point for selecting analytical methods for Brownfields site assessments. Additional methods may be available and appropriate; consult with the NBP Program or Quality Coordinators for approval of alternate methods. The site-specific SAP or FSP should identify analytical methods and equipment, decontamination procedures, waste disposal requirements, and performance requirements.

### B4.1 Detection and Quantitation Limits

The method detection limit (MDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a sample matrix. Project-required quantitation limits (PRQLs) are contractually specified maximum quantitation limits for specific analytical methods and sample matrices, such as soil or water, and are typically several times the MDL to allow for matrix effects. PRQLs, which are established by the NDEP in the scope of work for subcontract laboratories, are set to establish minimum criteria for laboratory performance; actual laboratory quantitation limits may be substantially lower. Each laboratory performing analyses under this program must routinely conduct MDL studies to document that the MDLs are less than the PRQLs. If any analytes have MDLs that do not meet the PRQLs, the following steps must be taken:

1. Perform a new MDL study using concentrations sufficient to prove analyte quantitation at concentrations less than the PRQLs per the procedure for the Determination of the Method Detection Limit presented in Revision 1.1," 40 CFR 136, 1984.
2. No samples may be analyzed until the issue has been resolved. Results of MDL studies must be available for review during audits, data review, or as requested. Current results

of MDL studies must be reported at the beginning of every project for review and inclusion in project files. An MDL is developed from seven aliquots of a standard containing all analytes of interest spiked at five times the expected MDL, which are taken through the analytical method sample processing steps. The data are the evaluated and used to calculate the MDL. If the calculated MDL is less than three times below the spiked concentration, another MDL study must be performed using a lower concentration

Laboratories generally establish quantitation limits (QLs) that are reported with the analytical results; these may be called reporting limits, detection limits, reporting detection limits, or other terms. These laboratory limits must be less than or equal to the PRQLs. The laboratories must have documentation to support quantitation at the required levels. Laboratories must report analytical results between the MDL and QL. These results must be reported as numerical valued and qualified as estimates. Reporting as "trace," "<QL," or "<PRQL" is not acceptable.

### B4.2 Laboratory Standards and Reagents

All stock standards and reagents used for extraction and standard solutions must be tracked through the laboratory. The preparation and use of all working standards must be recorded in bound laboratory notebooks that document standard tractability to EPA, A2LA or National Institute for Standards and Technology (NIST) criteria. The record must have sufficient detail to allow determination of the identity, concentration, and viability of the standards including any dilutions performed to obtain the working standard. The date of preparation, analyte or mixture, concentration, name of preparer, lot or cylinder number, and expiration date, if applicable, must be recorded on each working standard.

## B5: Quality Control

QC requirements are integral to the success of a QA program. QC covers the overall system of technical activities that measure the performance of a process against defined standards to verify that they meet predefined requirements. Because errors can occur in the field, laboratory, or office, it is necessary for QC to be part of each of these functions. This QA Program Plan describes and defines the general quality objectives of the NBP. Site-specific quality objectives are further defined in project-specific SAPs. This approach to quality system management ensures that quality activities are conducted throughout the project, but allows for the flexibility to tailor quality-related activities to individual projects, depending on the complexity of the Brownfields site.

QA and QC parameters apply to the two primary types of data — definitive and nondefinitive data — regardless of whether the data collection activity is associated with field measurements or laboratory measurements. Nondefinitive data are frequently collected during the first stage of a multi-phase screening assessment, using rapid, less precise methods of analysis with less rigorous sample preparation. Nondefinitive data can provide analyte identification and quantification, although both may be relatively imprecise. Typically, 10 percent of nondefinitive samples or all critical samples are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Nondefinitive data without associated confirmation data are of unknown quality. Qualitative, nondefinitive data identify the presence of contaminants and classes of contaminants and can help focus the collection of definitive data,

which is generally the more expensive of the two. Some data uses, such as risk assessments, require definitive data.

## B5.1 Quality Control in the Field

QC parameters should be described in detail for each step of field work and should also include specific corrective actions to be taken if difficulties are encountered in the field. Evaluation of field sampling procedures requires the collection and evaluation of field QC samples. Trip blanks, rinsate blanks, field duplicates, and extra volume for matrix spikes and matrix spike duplicates will be collected and submitted to the analytical laboratory to provide a means of assessing the quality of data resulting from the field sampling program. Collection frequencies for field QC samples are summarized in the Table B2 at the end of Section B of this QA Program Plan.

Field QC requirements and documentation of all field sampling and observations are critical for providing a historical record for analysis of the usability of the data produced. The official field log book will contain documentation of field activities that involve the collection and measurement of environmental data. Additional forms may be used in the field to record related activities as explained below.

SOPs delineate the step-by-step approach that field personnel must follow in collecting samples, taking field measurements, decontaminating equipment, handling IDW, and calibrating instruments. Most qualified sampling contractors and State and Federally certified laboratories develop SOPs and analytical methods as part of their overall QA program. SOPs should be developed following "Guidance for Preparation of Standard Operating Procedures for Quality-Related Operations" (EPA 1995). The field team should document which SOPs they are using in the field and any deviations from an SOP.

Equipment used for sample collection must be cleaned according to the specific procedures documented in each sampling SOP. Sampling SOPs will be prepared by the group responsible for sampling and will be submitted to NBP Program or Quality Coordinator for review and approval as part of the sampling plan. All sampling tools will be decontaminated before sampling begins and between sample locations. Soil and water sampling tools, including stainless-steel spoons, bowls, hand augers, split spoons, pumps, and Hydropunch equipment, will be decontaminated by scrubbing in a solution of potable water and nonphosphate detergent (Alconox or Liquinox). The tools will then be double-rinsed with distilled water. Sampling tools that are not used immediately after decontamination will be allowed to air dry and wrapped in aluminum foil. Larger equipment, such as the drilling rods and augers, will be decontaminated between boring locations. A temporary decontamination pad will be constructed near the site and a high-pressure steam cleaner will be used to clean the end of the rig and all augers, drill rods, and core samplers. Decontamination fluids will be placed in containers and disposed of in accordance with the procedures outlined in the SOP for IDW.

### *B5.1.1 Field Instrument/Equipment Inspection and Calibration*

Sampling and analysis generally requires the use of different pieces of equipment and tools in the gathering of environmental data. A field preventive maintenance protocol involves ensuring that

all field equipment has been properly calibrated, charged, and inspected prior to and at the end of each working day and that replacement parts are available.

All field equipment needs to be inspected to determine if it is adequate and appropriate for the media, parameters, and tests to be performed. Data may be generated onsite through the use of real-time equipment, such as photoionization detectors (PIDs), organic vapor analyzers, and pH meters. A more detailed analysis may call for relevant to later assessments of the usability of data generated by a mobile laboratory.

For field-testing and mobile laboratories, the team should track the transfer of samples, and equipment should be examined to ensure that it in working condition and properly calibrated. The calibration of field instruments should be performed according to the method and schedule specified in an SOP, which is usually based on the manufacturer's operating manual. Calibration of field equipment should be performed more often than specified in the SOP if equipment is used under adverse or extreme field conditions.

### *B5.1.2 Field Documentation*

The field team should record field activities in ink, in a bound notebook with prenumbered pages or on a preprinted form. For each sampling event, the field team must provide the site name and location, date, sampling start and finish times, names of field personnel, level of protection, documentation of any deviation from protocol, and signatures of field personnel. For individual samples, field teams should ensure that field logbooks document the exact location and time the sample was taken, any measurement made (with real-time equipment), a physical description of the sample, sample ID number, sampling depth, sample volume and type of sample, and the equipment used to collect the sample. This information can be critical to later evaluations of the resulting data's usability.

Complete and accurate documentation is essential to demonstrate that field measurement and sampling procedures are carried out as described in this QA program plan or the SAP/FSP. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the project name, the site name, and the names of subcontractors, the service client, and the project manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken

The field team will also use various field forms in Appendix G (or equivalent forms developed by the contractor) to record field activities.

Individual samples should be labeled in the field. Labels should include sample location, sample number, date and time of collection, sample type, sampler's name, and method used to preserve the sample, if applicable. (Sample preservation involves the treatment of a sample usually through the addition of a compound that adjusts pH to retain the sample properties, including concentrations of substances, until it can be analyzed.) The field team should follow the sample summary table (see Appendix G) for each sampling event. The table should include a listing of the total number of samples, types of sample matrices, all analyses planned for each sample differentiating critical measurements, and other information that may be relevant to later assessments of the data usability.

### *B5.1.3 Trip Blanks*

Trip blank samples are used to evaluate whether the shipping and handling procedures are introducing contaminants into the samples or if cross-contamination in the form of migration of VOCs between the collected samples. One trip blank will be submitted to the laboratory for analysis each day that samples are collected. Trip blanks for soil and water samples are VOA vials filled with purged deionized water that are transported to the field and then returned to the laboratory without being opened. Trip blanks for air samples are empty Summa canisters or tedlar bags, filled with zero air, which are transported to the field and then returned to the laboratory without being opened.

Trip blanks should not contain detectable concentrations of target analytes greater than the PRQL for the compound. Any detection of target analytes in a trip blank will result in an investigation to determine effect on overall data usability, and affected results may be qualified as estimates or as nondetects at an elevated MDL as appropriate

### *B5.1.4 Rinsate Blanks*

Rinsate blanks are collected to evaluate the potential for cross-contamination of samples during collection. Rinsate blanks will be collected at a rate of one per day per matrix when non-dedicated and non-disposable sampling equipment is used in the field. Equipment rinsate blanks will be obtained by passing organic-free water through or over the decontaminated sampling equipment, and collecting the water in appropriate sample containers.

Rinsate blanks will be analyzed for the same parameters as the associated field samples. Rinsate blanks should not contain detectable concentrations of target analytes greater than the PRQL for the compound. Any detection of target analytes in a rinsate blank will result in an investigation to determine effect on overall data usability, and affected results will be qualified as estimates or as nondetects at an elevated PRQL as appropriate.

### *B5.1.5 Field Duplicate Samples*

Field duplicate samples of water and air samples are samples that are collected simultaneously in separate containers. The purpose of field duplicates is to allow evaluation of the contribution of random error from sampling to the total error associated with the data.

Soils and sediments are generally too heterogeneous to assess the precision of sample collection, so duplicate soil samples from a site are generally no different (statistically) from independent samples. However, the size, complexity, and objectives of each project determine the sampling design for each Brownfields site. As a result, the collection of field duplicates for soils and sediments will be evaluated on a project-specific basis. Each project-specific SAP will specify as to why field duplicate samples of soil and sediment media are, or are not, needed.

For water and air samples, one set of field duplicates will be collected and submitted for every twenty field samples collected. Field duplicate precision will be evaluated as described below.

### *B5.1.6 Matrix Spike/Matrix Spike Duplicates (Field Requirements)*

Double sample volume should be collected at a rate of one per twenty samples per matrix (minimum of once per sampling event) to ensure that the laboratory has sufficient volume to perform matrix spikes and matrix spike duplicates (MS/MSDs).

### *B5.1.7 Interlaboratory Split Samples (Field Requirements)*

Interlaboratory split samples are field duplicates (liquid matrices) or split samples (solid matrices) that are submitted to both the primary laboratory and a secondary or QC laboratory. Interlaboratory split samples are collected simultaneously with a sample from the same source under identical conditions into separate containers. Results from the split samples are used to assess laboratory performance by comparison of qualitative and quantitative results from the two laboratories, including indications of matrix interferences such as elevated PRQLs. In order to provide useful information, however, the split sample must be directly associated with the original (primary) sample to evaluate laboratory performance. The association will be determined by field personnel and maintained during the data import process.

## B5.2 Quality Control in the Laboratory

Laboratory QC samples are used to monitor the laboratory's precision and accuracy of the analytical procedure results. Laboratory QC samples are analyzed as part of the standard laboratory QC protocols and are accomplished through analyzing method blanks, laboratory control samples (blank spikes), surrogate spikes, and internal standards. Not all analyses require the above QC sample types. Typically, these QC samples are not required for non-SW-846 methods. Method-specific laboratory QC samples and acceptance limits specified in this QA Program Plan are summarized in Tables D-1 through D-7 in Appendix D.

### *B5.2.1 Method Blanks*

Method blanks will be used to check the level of background contamination in the laboratory. Laboratory method blanks will be analyzed with each sample batch. Results will be compared to all samples within the same analytical batch.

QC criteria require that no contaminants be detected in the blank(s) above the PRQL. If an analyte (contamination) is detected, the action taken will follow the laboratory SOPs and QA

manuals. Blank samples will be analyzed for the same parameters as the associated field samples.

### *B5.2.2 Laboratory Control Samples*

Laboratory control samples (LCSs) are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects. The LCSs are prepared by spiking reagent water or silica sand with standard solutions prepared independently of those used in establishing instrument calibration. The LCSs are extracted and analyzed with each batch of samples. Results are compared on a per-batch basis to pre-established control limits and are used to evaluate laboratory performance for precision and accuracy.

### *B5.2.3 Laboratory Duplicates*

Precision of the analytical system is evaluated by using laboratory duplicates for inorganic parameters only. Laboratory duplicates are two portions of a single homogeneous sample digested and analyzed for the same parameters. LCS duplicates will be prepared and analyzed for all batches when MS/MSDs are not available. Laboratory duplicates (primary sample split into two) will be prepared and analyzed for all batches requiring duplicates as specified per method in the laboratory QA manuals. The calculations for relative percent difference (RPD) (precision) are described in Section B5.3.1. Not all methods require laboratory duplicates, and MSDs are generally preferred for analysis of organic chemicals.

### *B5.2.4 Surrogate Spikes*

Surrogate spikes are used to evaluate accuracy, method performance, and extraction efficiency. Surrogate compounds are compounds not normally found in the environmental samples; however, they are similar to the target analytes in chemical composition and behavior in the analytical process. Samples for organics analysis will be spiked with surrogate compounds consistent with the requirements described in the laboratory's SOPs and QA manuals.

Because sample characteristics will affect the percent recovery (%R), the %R is a measurement of accuracy of the overall analytical method on each individual sample. The %R of surrogates is calculated concurrently with the analytes of interest, using the equation in Section B5.3.2.

### *B5.2.5 Matrix Spike/Matrix Spike Duplicates*

Matrix spikes are used to evaluate analytical precision and accuracy on a specific sample matrix. Because MS/MSD samples measure the matrix interference of a specific matrix, the laboratory should perform MS/MSDs on site-specific samples. This requirement will be waived if insufficient sample volume is collected.

MS/MSDs should be analyzed for the same parameters as the associated field samples in the same analytical QC batch and the results will be expressed as percent recoveries of known spiked amounts and as RPDs for the MS/MSD pairs.

### *B5.2.6 Internal Standards*

Internal standards are used in gas chromatography/mass spectrometry (GC/MS) and inductively coupled plasma (atomic emission spectroscopy)/mass spectrometry (ICP/MS) analyses. A constant amount of internal standard is added to all standards, samples, extracts, or digestates. The ratio of the peak area, height, or intensity of the target analyte to the peak area, height, or intensity of the internal standard in the sample, extract, or digestate is compared to a similar ratio derived for each calibration standard. The target analyte response is calculated relative to that of the internal standard.

For GC/MS analyses of soil and water samples, internal standard areas or heights for all blanks, samples, and spikes must be 50 percent to 200 percent of the internal standard areas or heights from the last passing continuing calibration (CCAL). The laboratory must re-prepare and/or reanalyze any blank, sample, or spike that does not meet this goal. If the internal standard area or height does not meet the goal upon reanalysis, the laboratory must include a discussion of the possible cause and effect on data usability in the case narrative.

For high-resolution gas chromatography and high-resolution mass spectrometry (HRGC/HRMS) analyses of soil and water samples, internal standard recoveries for all blanks, samples, and spikes must be between 40 percent and 135 percent in 8290 analyses or 25 percent to 150 percent in 1613B analyses. If the internal standard recovery does not meet this MQO, the laboratory must include a discussion of the possible cause and effect on data usability in the case narrative.

For TO-15 analyses of air samples, internal standard areas for all blanks, samples, and spikes must be 60 percent to 140 percent of the internal standard areas from the last valid initial calibration (ICAL). The laboratory must re-prepare and/or reanalyze any blank, sample, or spike that does not meet this goal. If the internal standard area does not meet this MQO upon reanalysis, the laboratory must include a discussion of the possible cause and effect on data usability in the case narrative.

For ICP/MS analyses, the intensity of each internal standard must fall between 30 percent and 120 percent of the intensity of that internal standard in the initial calibration standard. If the intensity is outside of acceptance limits then the sample must be diluted fivefold and reanalyzed with the addition of appropriate amounts of internal standard. This procedure must be repeated until the internal standard intensities are within acceptance limits. Internal standard intensity levels for calibration blanks and instrument check standards must agree within ±20 percent of the intensity level of the internal standard in the original calibration solution. If the internal standard intensity level for any calibration blank or instrument check standard is outside of acceptance limits, analysis must be terminated, the problem corrected, the system recalibrated, the calibration verified, and all affected samples must be reanalyzed.

### *B5.2.7 Performance Evaluation Samples*

The team may also decide to audit its laboratory by submitting PE samples to the laboratory along with the other environmental samples collected at the Brownfields site. A PE sample is a sample of known composition provided for laboratory analysis to monitor laboratory and method laboratory performance. A PE sample can be used to rate the laboratory's ability to produce analytical results within the pre-set limits documented in the QA Program Plan or SAP. PE

samples may be the simplest and most cost-effective way to audit a laboratory. Laboratories that participate in EPA's Contract Laboratory Program (CLP) and State programs typically analyze PE samples on a routine basis. The team should request a copy of the laboratory's PE results as part of its audit program and may rely on existing audit information.

### B5.3 Data Quality Indicators

Data processing, verification, and validation are the quality management tools used to determine if project data meet the planned DQOs and requirements defined in this QA Program Plan and in site-specific SAPs. During data processing and validation, project data should be evaluated for completeness, correctness, and compliance against the method, procedural, or contractual requirements of the project. Verified data can then be validated against performance measures and DQOs established in this QA Program Plan and in site-specific SAPs.

The following data qualifiers ("flags") should be used by analytical laboratories providing services on Brownfields site assessments. Laboratories may use additional data qualifiers and subqualifiers; however, each qualifier must be defined unambiguously in the analytical report.

- **J** - The analyte was positively identified but the associated numerical value is the approximate analyte concentration in the sample. Analytes must be J qualified when detected concentrations are less than the PRQL but greater than the MDL.

- **U** - The analyte was analyzed for but was not detected. The associated numerical value is provided as the sample-specific MDL, also called the sample quantitation limit (SQL).

- **N** - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration. When analytical methods requiring second column confirmation are performed, analytes must be N qualified when there is greater than 40 percent difference between analyte concentrations on the primary analytical column and secondary (confirmation) column.

- R – The datum is rejected if quality control samples and procedures do not meet control limits, as described in the functional guidelines. These data are unusable for decision-making and any other purposes. An explanation of the rejected data should be included in the data validation report.

Data validation is accomplished by evaluating the data against the following DQIs:

- Precision

- Accuracy (Bias)

- Representativeness

- Comparability

- Completeness

- Sensitivity

The generic data assessment criteria for data from Brownfields project are discussed and defined in the following subsections and in Appendix D of this QA Program Plan. The laboratory should be contacted when developing site-specific SAPs to verify that quality and measurement criteria can be met.

### *B5.3.1 Precision*

Precision is defined as the agreement between or among repeated measures of the same sample; that is, precision is the degree of analytical reproducibility. Precision will be measured as the RPD between duplicate analyses when analyte concentration is greater than five times the MDL and as an absolute concentration based on the MDL when analyte concentration is less than five times the MDL.

When analyte concentrations are more than five times the MDL, precision will be calculated as the RPD as follows:

$$\%RPD_i = \left( \frac{2 \times \left| O_i - D_i \right|}{\left( O_i + D_i \right)} \right) \times 100$$

Where:

| | | |
|---|---|---|
| $\%RPD_i$ | = | Relative percent difference for compound i |
| $O_i$ | = | Concentration of compound i in original sample or MS |
| $D_i$ | = | Concentration of compound i in duplicate sample or MSD |

For laboratory precision, performance goals will be:

- RPD between duplicate blank spikes less than or equal to 20 percent.
- RPD between laboratory duplicate samples less than or equal to 30 percent for analyte concentrations greater than or equal to five times the MDL, and the absolute concentration difference less than or equal to the MDL for analyte concentrations less than five times the MDL.
- RPD between MSDs less than or equal to 40 percent.

If these goals are not met, the laboratory will investigate why the criteria were exceeded and will include a discussion of the exceedance and any impact on data usability in the case narrative. If the cause of the exceedance is determined to be laboratory error, the laboratory will reanalyze the sample, as appropriate.

Precision related to sample collection in the field will be monitored as the difference between field duplicates for water and air samples. The RPD between field duplicates for samples with

analyte concentrations greater than the MDL will be less than or equal to 40 percent for aqueous and air samples. The absolute concentration difference between duplicate samples with concentrations less than five times the MDL will be less than or equal to the corresponding MDL.

### *B5.3.2 Accuracy (Bias)*

Accuracy is the amount of agreement between a measured value and the true value. It will be monitored as the %R of the MS or MSD, laboratory control samples (also known as blank spikes), and surrogate spike compounds. It will also be measured using the analytical results of instrument calibration and other laboratory internal standards. Project-specific goals for each type of sample and analytical method are discussed below and will be applied unless an analytical method contains other defined performance criteria.

Accuracy will be calculated as the %R of analytes as follows:

$$\%R_i = \left( \frac{Y_i}{X_i} \right) \times 100$$

Where:

$\%R_i$ = percent recovery for compound i

$Y_i$ = measured analyte concentration in sample i (measured - original sample concentration)

$X_i$ = known analyte concentration in sample i

The accuracy goal for organic analytes and surrogate spike recovery in LCSs is 70 to 130 percent of the true value for all compounds. Recovery in this range should be routinely achievable as the spike is added to an interference-free matrix. Sporadic failure of a single organic analyte to meet the 70 to 130 percent recovery goal may be tolerated as long as the laboratory can prove that exceedance of the QC limit does not indicate a systematic recovery problem for the analyte. As much as 5 percent of the organic analytes may fail to meet the 70 to130 percent recovery goal without requiring re-extraction/reanalysis, as long as the laboratory can demonstrate that the recovery outside of acceptance limits does not indicate a systematic recovery problem, but is sporadic in nature. The laboratory case narrative must include a discussion of the effect of any recovery outside the 70 to 130 percent limits set for organic analytes.

The %R goal for inorganic analyte recovery in LCSs is 80 to 120 percent of the known value for all compounds. Recovery in this range should be routinely achievable as the spike is added to an interference-free matrix. The %R goal for recovery of analytes and surrogate compounds spiked into the sample matrix is 60 to 140 percent recovery. Results outside these limits must reflect complexities in the sample matrix rather than procedural bias in the laboratory. All matrix-related recovery problems must be adequately documented in the laboratory report and raw data. Compliance with this %R goal will be assessed by comparison of analyte and surrogate recovery

in the sample matrix to laboratory performance on method blanks and blank spikes and through the data validation and verification process.

### *B5.3.3 Representativeness*

Representativeness is the degree to which data accurately and precisely represent a parameter variation at a sampling point or for an environmental condition. The results of all analyses will be used to evaluate the data to determine if the samples were collected in such a manner that the results appropriately describe the area investigated.

Field procedures to ensure that samples are representative of the project site are discussed in the site-specific SAP or FSP. Representativeness of laboratory data will be achieved by following standardized procedures for subsampling, which will include the following elements at a minimum:

- If an aqueous sample is subsampled for analysis, the sample will be mixed by inversion prior to removal of the analytical aliquot unless doing so would compromise analytical results.

- Soil samples will be thoroughly mixed prior to removal of analytical subsamples for all analyte classes except for VOCs. If analysis for VOCs must be performed on bulk soil samples, the sample core must be taken from the center of the bulk container and all results must be qualified as exhibiting a possible low analytical bias.

### *B5.3.4 Comparability*

Comparability is the degree to which data from one study can be compared with data from other similar studies, reference values (such as background), and screening values. Field procedures to promote comparability of collected samples are discussed in the project planning documents, including SOPs. Comparability of laboratory results will be achieved by following standardized analytical procedures, using traceable reference materials, using Class A volumetric glassware or correctly calibrated pipettes for volumetric procedures, using correctly calibrated balances for gravimetric procedures, and following good laboratory practices.

The NDEP requires strict adherence to method QC and procedural requirements and the requirements of this QA Program Plan, or proper documentation by the laboratory of deviations from the analytical methods. If undocumented method deviations are discovered during data validation, NDEP chemists will evaluate potential effects on data usability and comparability and will contact the laboratory for corrective action.

### *B5.3.5 Completeness*

Completeness is defined as the percentage of usable data out of the total amount of data generated. Analytical completeness is a measure of the number of overall accepted analytical results (valid results), including estimated values, compared to the total number of analytical results requested on samples submitted for analysis after review of the analytical data. Less than 100 percent completeness can occur if high concentrations necessitate dilutions, such that PRQLs are exceeded for some parameters. Highly contaminated environments may also present

complex matrices that produce analytical interferences and prevent the achievement of specified precision and accuracy criteria. Therefore, the target goal for completeness as a whole shall be 90 percent for both field and laboratory analytical methods. Completeness for project-specific data needs shall be 95 percent for each individual method. Project-specific data needs will be defined on an individual batch basis and will consist of data for which all QC criteria were met.

Completeness will be calculated as follows:

$$\%C = \frac{A}{I} \times 100$$

Where:

%C = Percent completeness (analytical)

A = Actual number of samples collected/valid analyses obtained

I = Intended number of samples/analyses requested

Rejection of data due to severe matrix interference is sometimes unavoidable. NDEP chemists will work with the laboratories to minimize these problems if possible and will document any steps taken to alleviate such problems.

Rejection of data due to laboratory performance issues is typically unacceptable. NDEP chemists will closely monitor laboratory performance during project execution to minimize the potential for discovery of severe data quality issues after the data are reported. Project laboratories are expected to pay careful attention to analytical procedures and method requirements, and to implement corrective actions to avoid rejection of results.

### *B5.3.6 Analytical Sensitivity*

Analytical sensitivity is the lowest concentration of a variable that can be reliably measured in a given sample. To ensure that analytical data are useful, the lowest reporting limit (LRL) for a given analyte should be either well below the lowest expected ambient environmental concentrations or below any applicable regulatory action levels. Although the LRL can vary from sample to sample due to matrix interferences and other analytical issues, under most conditions the LRL is fixed for a given analytical method. The routine LRLs for water quality variables analyzed for this program are listed in Appendix D.

## B6 Instrument/Equipment Testing, Inspection, and Maintenance

All field and laboratory analytical instruments and equipment will be tested, inspected, and maintained according to the manufacturer's guidelines and recommendations. Data collected from improperly functioning equipment will not be used.

Records for equipment testing, inspection, and maintenance will be maintained in a bound logbook for each piece of equipment. The date, time, name of inspector, what was inspected and

the results of testing and inspection will be recorded in the logbook. All equipment or systems requiring periodic maintenance will be inspected.

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in (1) the equipment manufacturer's literature or operating manual, or (2) SOPs that describe equipment operation associated with particular applications of the instrument. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements.

A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The field team leader will be notified of equipment malfunctions so that service can be completed quickly or substitute equipment can be obtained. When the condition of equipment is suspect, unscheduled testing, inspection, and maintenance should be conducted. Any significant problems with field equipment will be reported in the daily field QC report.

Testing, inspection, maintenance of analytical equipment use by the contract laboratory, and corrective actions shall be documented in the QA manuals for each analyzing laboratory. The laboratory QA manual must be submitted to the NDEP project manager for review and approval prior to start of sampling and analyses.

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected for this project. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will include equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory's QA plan and written SOPs will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures, the frequency and type of maintenance performed, and procedures for documenting maintenance activities.

Laboratory equipment malfunctions will require immediate corrective action. Actions should be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

The equipment testing, inspection, and maintenance logs for all contractor equipment must be made available to the NBP Program or Quality Coordinator or the NBP Supervisor upon request.

### B7 Instrument/Equipment Calibration and Frequency

Calibration of all analytical instrumentation is required to ensure that the analytical system is operating correctly and functioning at the sensitivity that is required to meet project-specific

DQOs. Each instrument will be calibrated with standard solutions appropriate to the instrument and analytical method, in accordance with the methodology specified and at the QC frequency specified in laboratory or field sampling SOPs.

### B7.1 Field-Based Instruments

Field equipment, if used, will be calibrated at the beginning of the field effort and at prescribed intervals. The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendation of the manufacturer. Detailed calibration procedures for field equipment are available from the specific manufacturers' instruction manuals, and general guidelines are included in SOPs. All calibration information will be recorded in a field logbook or on field forms. A label that specifies the scheduled date of the next calibration will be attached to the field equipment. If this type of identification is not feasible, equipment calibration records will be readily available for reference. Field-based analytical instruments, such as turbidometers and pH electrodes must be calibrated following manufacturers' instructions and frequency recommendations (or following appropriate SOPs) before they may be used for collecting data.

### B7.2 Laboratory Instruments

Calibration and maintenance of analytical instruments will be conducted in accordance with the QC requirements identified in each laboratory SOP and QA manuals, and the manufacturers' instructions. General requirements are discussed below.

The history of calibration and maintenance for instruments in the subcontract laboratory is an important aspect of the project's overall QA/QC program. As such, all initial and continuing calibration procedures will be implemented by trained personnel following the manufacturer's instructions and in accordance with applicable EPA protocols to ensure the equipment is functioning within the tolerances established by the manufacturer and the method-specific analytical requirements.

The laboratory will obtain calibration standards from commercial vendors for both inorganic and organic compounds and analytes. Stock solutions for surrogate standards and other inorganic mixes will be made from reagent-grade chemicals or as specified in the analytical method. Stock standards will also be used to make intermediate standards that will be used to prepare calibration standards. Special attention will be paid to expiration dating, proper labeling, proper refrigeration, and freedom from contamination. Documentation on receipt, mixing, and use of standards will be recorded in the appropriate laboratory logbook. Logbooks must be permanently bound. Additional specific handling and documentation requirements for the use of standards may be provided in subcontractor laboratory QA plans.

The verification standards for initial calibrations should be analyzed after the instrument calibration to verify the preparation and concentration of the calibration standards. The verification standards for continuing calibrations should be analyzed (as per method requirements) to verify the calibration of the analytical system over time.

Analytical balances will be calibrated annually according to manufacturer's instructions and have a calibration check before each use by laboratory personnel. Balance calibration shall be documented in hardbound logbooks with pre-numbered pages.

All refrigerators will be monitored for proper temperature by measuring and recording internal temperatures on a daily basis. At a minimum, thermometers used for these measurements will be calibrated annually, according to manufacturers' instructions.

The subcontract laboratories will maintain an appropriate water supply system that is capable of furnishing ASTM Type II polished water to the various analytical areas.

## B8 Inspection/Acceptance of Supplies and Consumables

The laboratory shall inspect supplies and consumables prior to their use in analysis. The description of materials provided in the method shall be used as a guideline for establishing the acceptance criteria for these materials. Purity of reagents shall be monitored by analysis of LCSs. An inventory and storage system for these materials shall assure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in "Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers" (EPA 1992).

Procedures for receiving supplies and consumables in the field are similar. When supplies are received, the project manager or field team leader will inspect all items against the acceptance criteria. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

## B9 Non-direct Measurements

Data from non-measurement sources, such as computer databases, computer programs, or scientific publications, must be approved for use by the NDEP in this QA Program Plan, or in a site-specific SAP or FSP.

## B10 Data Management

Field data from Brownfields site assessments, such as sample ID and latitude/longitude coordinates, should be recorded on field data sheets or hand-held computers. Field data are reported to the Project Manager through submission of field notebooks or field sampling data sheets, if used, by contractor field staff.

Laboratory analytical reports will include QC results and any other necessary analytical information, enabling reviewers to determine data quality. Laboratory data should be submitted to the NDEP Project Manager in both printed and electronic form. Rapid turnaround data from the laboratory are reported to the Project Manager, if requested, but rapid turnaround is generally not required for Brownfields projects. Copies of field logs, a copy of chain-of-custody forms, original preliminary and final lab reports, and electronic media reports must be kept for review by the NDEP. The field crew must retain original field logs. The contract laboratory shall retain

chain-of-custody forms. The contract laboratory will retain copies of the preliminary and final data reports.

The NDEP will supply instructions for the required format for EDDs produced by analytical laboratories. EDDs from the laboratory will be verified and loaded into NDEP's environmental database. This database will be the repository from which data may be retrieved for evaluation. Any errors found during the course of data evaluation will be corrected in the database, with documentation noting the error, reason, and date of correction.

In partnership with the Environmental Data Standards Council (EDSC), the EPA is developing data standards for environmental information collection and exchange. Data standards being adopted by the EDSC can be found at www.envdatastandards.net The latest overview of standards applicable to environmental sampling, analysis, and data was published January 6, 2006 and is available at http://www.epa.gov/edr/ESAROverview_01062006.pdf

All results meeting DQOs and results having satisfactory explanations for deviations from objectives shall be reported. The final results shall include the results of all field and laboratory QC samples.

**Table B1.** Common Contaminants at Nevada Brownfields Sites and Recommended Methods for Analysis of Soil Samples

| Product | Parameter/ Constituent | Lab Test Protocol & Number | Detection Level | Notification Level | Action Level | Cleanup Level |
|---|---|---|---|---|---|---|
| Gasoline | TPH | Modified EPA 8015 | 10 mg/kg | > 25 Gallons or 3 Cubic Yards* | 100mg/kg | 100mg/kg |
| Diesel | TPH | Modified EPA 8015 | 10 mg/kg | > 25 Gallons or 3 Cubic Yards* | 100mg/kg | 100mg/kg |
| Waste Oil | TPH | Modified EPA 8015, TCLP Inorganics | 10 mg/kg | > 25 Gallons or 3 Cubic Yards* | 100mg/kg | 100mg/kg |
| Metals | Lead, arsenic | EPA method 6010B | 0.5 mg/kg | | | |

* NDEP prefers use of Purge and Trap (P&T) techniques for analysis of Gasoline releases via Modified EPA Method 8015. NDEP prefers the use of Extractable Techniques for analysis of non-Gasoline (i.e. Diesel, Motor Oil, and Waste Oil) via Modified EPA Method 8015. See: http://www.epa.gov/epaoswer/hazwaste/test/main.htm for additional information from EPA Region 9 Quality Assurance.

The characterization must include all constituents of concern to be evaluated in the risk analysis, and must use EPA-approved analytical methods. NDEP recommends the following analyses to comply with the requirements of both items 1 and 2.

- Volatile Organic Compounds (VOCs) by EPA method 8260B and Semi-Volatile Organic Compounds (SVOCs) by EPA method 8270C.

- Eight metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) by Toxicity Characteristic Leaching Procedure (TCLP) using an extraction via EPA method 1311 and analyses via EPA method 6010B or 6020 for all except mercury, which may be analyzed via EPA method 6020 or 7470A.

- Total Petroleum Hydrocarbons (TPH) purgeable (TPHp) and extractable (TPHe) by EPA method 8015 Modified.

Depending on the results obtained from these analyses, and the risk evaluation method chosen, additional analyses for certain VOCs or SVOCs by TCLP may be required.

**Table B2**. Collection Frequencies for Field Quality Control Samples

| Field QC Type | Frequency |
|---|---|
| Trip Blank | One per day per cooler containing VOC samples |
| Rinsate Blank | One per day when nondedicated sampling equipment is used |
| Field Duplicates | 5 percent (1 in 20 samples) per matrix per analysis. Minimum of 1 per analysis. Field duplicates are collected for water and air samples, but need not be collected for soil or sediment samples. |
| Matrix Spike/Matrix Spike Duplicate | 5 percent (1 in 20 samples) per matrix per analysis. Minimum of 1 per analysis (Noted here because twice the volume must be collected for MS/MSD analysis) |
| Interlaboratory Split Sample | 5 percent (1 in 20 samples) per matrix (optional) (Noted here because additional sample volume must be collected for interlaboratory analysis) |
| Field Instrument Calibration | Instrument-specific. Follow instrument specifications and sampling SOPs |

Notes:
VOC = Volatile organic compounds
MS/MSD = Matrix spike/matrix spike duplicate
SOPs = Standard Operating Procedures

## GROUP C: ASSESSMENT AND OVERSIGHT ELEMENTS

### C1 Assessments and Response Actions

Assessment and response actions are part of the quality system for ensuring and documenting the procedures required by this QA Program Plan and by site-specific SAPs or FSPs are being followed during the generation of data for Brownfields sites.

### C1.1 Purpose/Background

During the planning process, many options for sampling, sample handling, sample analysis, and data reduction are evaluated. Selection of specific options depends on the nature of the corrective action or monitoring activity. This section of the QA Program Plan describes the internal and external checks necessary to ensure that all elements are correctly implemented. In addition, checks are needed to ensure that the quality of the data is adequate and that corrective actions are implemented in a timely and effective manner. Documenting all internal assessments is a critical component of the quality system.

### C1.2 Assessment Activities and Program Planning

A number of assessment activities are available to managers to evaluate the effectiveness of program implementation. These include audits, peer reviews, and other activities, as discussed in the following sections.

#### *C1.2.1 Assessment of Subsidiary Organizations*

Management assessment is generally accomplished through a management systems review (MSR), which is a qualitative assessment to evaluate whether the quality management structure, policies, practices, and procedures are adequate to ensure the type and quality of data collected under this program. EPA provides guidance (Guidance for the Management Systems Review Process, QA/G-3, 2003) for conducting MSRs. MSRs may also include providing technical assistance to improve the quality system.

MSRs are a necessary component of the overall Quality System and serve the purpose of identifying problems that need to be addressed to improve the Quality System. For the NBP, MSRs will be conducted by EPA every 4 years, as defined in EPA Order 5360.1. The MSR process will produce a draft report that details findings and recommended corrective actions for the NDEP program. MSRs are a useful means to bring attention to areas of needed improvement and a useful mechanism for communication between the NDEP and the EPA.

#### *C1.2.2 Assessment of Program Activities*

<u>Field Audits</u>

The NDEP will conduct field audits of contractors shortly after they have begun project work. These field audits will be used to reveal any weaknesses in management structure, policy, practices, or procedures. Experienced NDEP staff members will perform the audits. The

purpose of these audits by the NDEP is to support data quality and encourage continuous quality improvement. During field work, the contractor should routinely observe field operations to ensure consistency and compliance with sampling specifications presented in this document and in project-specific SAPs or FSPs that will be developed later. An audit checklist will be used to document field observations and activities.

During a field audit, the NDEP assessor will use personnel interviews, direct observations, and reviews of project-specific documentation to evaluate and document whether procedures specified in this QA program plan and the project-specific SAP or FSP are being implemented. Specific items that may be observed during the audit include:

- Availability of approved project plans such as the SAP and Health and Safety Plan (HASP) to all project members
- Documentation of personnel qualifications and training
- Sample collection, identification, preservation, handling, and shipping procedures
- Decontamination procedures used to clean sampling equipment
- Equipment calibration and maintenance
- Completeness of logbooks and other field records (including nonconformance documentation)

During the field audit, the NDEP assessor will verbally communicate any significant deficiencies to the field team and project manager for immediate correction. These and all other observations and comments will also be documented in an audit summary. The audit summary will be issued to the contractor project manager and EPA program QA manager in electronic (e-mail) format within 7 days after the audit is completed.

Surveillance

Surveillance is intended for use in identifying repeated non-compliance due to deficiencies in the QC program requiring remedy through either greater enforcement of provisions in the QA program plan or correction of the problematic elements. Surveillance is also intended to identify and investigate fraud or other efforts to deceive as a result of convenience or personal gain. Due to the investigative nature of some surveillance activities, any action taken by the NBP Program Coordinator may be initiated without the knowledge or consent of the subject, though their involvement will be sought prior to any disciplinary action.

In determining whether to initiate surveillance activities, the NBP Program Coordinator will consult with the Superfund and Brownfields Branch Supervisor in presenting both the information that serves as the basis for the suspicion of non-compliance and a plan for verification. It will be the Supervisor's responsibility to authorize the time and resource commitment necessary to undertake appropriate surveillance activities and to monitor the methods and actions taken by the NBP Program Coordinator.

In any instance where the NBP Program Coordinator believes that the QC provisions of this QA program plan, or any associated FSP/SAP submitted to the program as part of a requirement of the program plan, are not being followed appropriately, he/she may take action to verify the noncompliance, determine the circumstances, and document the findings. Actions may include, but are not limited to, conducting of interviews with field personnel, reviewing field logs or other field documentation, observing sampling efforts, and holding discussions with managers or other quality control officers. These types of surveillance activities may be initiated in response to instance- or personnel-specific inconsistencies observed during routine QC checks. Surveillance may be either short or long term, depending on the nature of the presumed non-compliance.

The findings of surveillance actions will be documented by the NBP Program Coordinator and compiled in the YSA. The report of findings must be accompanied by a plan for either corrective or disciplinary action if the finding of non-compliance is confirmed.

Audits of Data Quality

EPA QA Project Plan guidance (2001) defines an audit of data quality (ADQ) as "a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality." An ADQ reveals how the data were handled for the project and may identify any systematic errors in data reduction. ADQs for the NBP will be conducted internally by the laboratory and involve a detailed review of the data, including review of instrument print-outs and other raw data. ADQs are comparable to full data validation, but are carried out by the laboratory QA manager and do not result in qualification or rejection of data. An ADQ should trace at least 10 percent of the data from initial acquisition, through reduction and statistical comparisons, to final reporting of the analytical results.

Peer Reviews

Peer reviews are not strictly an internal QA function; rather, they are technical scientific reviews that evaluate assumptions, calculations, methods, and conclusions. The NDEP will use internal expertise to evaluate different technical aspects of the reports produced by contractors.

Data Quality Assessment

A data quality assessment (DQA) generally applies statistical tools to evaluate whether the data achieved the DQOs specified for the project. EPA guidance for DQA (EPA 2006b, 2006c) discusses the types of statistical analysis and their uses. However, use of statistical tools may be limited if few data are collected or if samples were collected using a biased (judgmental) design. In the case of nonstatistical studies, the DQA process will still be used to evaluate whether project objectives, as defined by project DQOs, have been met. The NBP Quality Coordinator has significant experience and expertise in the DQO and DQA processes, and will evaluate the contractor's reports to confirm that project DQOs were achieved and that the data analysis is thorough and correct..

Technical System Audits/Yearly Systems Audit

Technical system audits (TSAs) are thorough and systematic qualitative audits that examine facilities, equipment, personnel, training, SOPs, and records for conformance to the QA program plan and site-specific SAP or FSP. The TSA will be satisfied by the YSA report, which represents a compilation of project-specific audit elements taken throughout the year. Specifically, the YSA includes the results of field audits taken by the NDEP during contractor field activities (sampling and remediation). The YSA also evaluates the performance of program QA elements and would offer the opportunity to make recommendations or changes to the QA program.

The YSA report will be assembled by the NBP Program and Quality Coordinators and will be subject to review by NDEP management. The YSA report is transmitted to the EPA Region 9 QA Officer.

## C1.3 Documentation of Assessments

This section identifies the organization and the person(s) that will perform the assessments, as well as the documentation of information collected during the audit.

### *C1.3.1 Number, Frequency, and Types of Assessments*

MSRs of the NBP will be conducted every 4 years by the EPA QA manager. TSAs of contractors by NDEP staff complement the use of SOPs and other QA planning documents to ensure data quality. These audits will be conducted at least once for each NBP project. Standardized checklists for audits are attached as Appendix H to this QA Program Plan. The in-text table below summarizes the number and frequency for the various types of audits.

### *C1.3.2 Assessment Personnel*

Personnel conducting assessments will have special training or technical experience that gives them the specific expertise to conduct the audit. Staff from the EPA will perform the MSR of the NBP and report the results to the NBP Program Coordinator and Supervisor, who will discuss the results with the NBP team. The NDEP will conduct TSAs of contractors for every NBP project and provide feedback to the contractor. Laboratory QA personnel will conduct ADQs and report results to the NBP Program and Quality Coordinators. The NBP Quality Coordinator will evaluate DQOs and the DQA process used for each NBP project. .

### *C1.3.3 Schedule of Assessment Activities*

Criteria to serve as a guideline for field operations and laboratories are provided in Appendices to this QA Program Plan. The full audit checklist for laboratory analysis is included as Appendix H-1. The audit checklist for field audits is included as Appendix H-2, and covers field SOPs, interviews with field personnel, and inspection of field records. The following in-text table outlines the type, schedule, and personnel for each type of audit.

### *C1.3.4 Reporting and Resolution of Issues*

Nonconformance to practices and procedures outlined in this QA Program Plan or project-specific SAP will be addressed in a timely manner to ensure that nonconforming issues or deficiencies are corrected. The ultimate responsibility to ensure that all issues and deficiencies are satisfactorily resolved rests with the NBP Program Coordinator.

| Type of Audit | Auditor | Schedule | Reporting | Distribution |
|---|---|---|---|---|
| MSR | EPA | Once every 4 years | Written report | NDEP Brownfields Manager |
| Readiness Review | Contractor Project Manager or Field Team Leader | Before field work commences | Checklist | NDEP Brownfields Manager |
| Field audit | NDEP | At least once per project | Written summary | Contractors |
| Surveillance | NBP Program Coordinator | No regular schedule; as deemed necessary | Written "Report of Findings" | Contractors |
| ADQ | Laboratory QA Manager | At least once per project | Written summary | NDEP Brownfields Manager |
| Performance Evaluation | Laboratory QA Manager | As specified for NELAC-certified and Nevada-certified laboratories | As specified in certification documents | NDEP Brownfields Manager |
| Peer Review | NDEP experts | Draft report for each Brownfields project | Written summary | NDEP Brownfields Manager |
| DQA | NBP Quality Coordinator | Draft report for each Brownfields project | Written summary | NDEP Brownfields Manager and EPA QA Manager |
| YSA | NBP Program Coordinator | Annually | Written report | EPA QA Manager and NDEP team |

### *C1.3.5 Corrective Actions*

The NDEP Manager or designee shall keep a log of any issues identified through the QA audit reports described above, as well as the corrective action taken to address these issues. Possible problems requiring corrective action include:

- Sample contamination,
- Equipment malfunction, and
- Non-compliance with QC systems.

Any non-conformance with the established QC procedures outlined in the QA program plan shall be identified and corrected. The NBP Program or Quality Coordinator shall issue a corrective action memorandum for each non-conformance condition and resolution.

Field Corrective Actions

Field corrective action procedures will depend on the type and severity of the finding. The NDEP classifies assessment findings as either deficiencies or observations. Deficiencies are findings that may have a significant impact on data quality and that will require corrective action. Observations are findings that do not directly affect data quality, but are suggestions for consideration and review.

As described previously, project teams are required to respond to deficiencies identified in TSA reports. The NDEP project manager will discuss the deficiencies and the appropriate steps to resolve each deficiency by taking the following steps:

- Identifying when and how the problem developed
- Assigning responsibility for problem investigation and documentation
- Selecting the corrective action to eliminate the problem
- Developing a schedule for completing the corrective action
- Assigning responsibility for implementing the corrective action
- Documenting and verifying that the corrective action has eliminated the problem
- Notifying the EPA Region 9 QA manager of the problem and the corrective action taken

In responding to the TSA report, the project team will include a brief description of each deficiency, the proposed corrective action, the individual responsible for selecting and implementing the corrective action, and the completion dates for each corrective action. The NBP Program or Quality Coordinator will use a status report to monitor all corrective actions.

The NBP Program or Quality Coordinator is responsible for reviewing proposed corrective actions and verifying that they have been effectively implemented. Either NBP Coordinator can require data acquisition to be limited or discontinued until the corrective action is complete and a deficiency is eliminated. The NBP Program or Quality Coordinator can also request the reanalysis of any or all samples and a review of all data acquired since the system was last in control.

Laboratory Corrective Actions

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occur: control limits are exceeded, method QC requirements are not met, or sample-holding times are exceeded.

The laboratory will report out-of-control situations to the NBP Program and Quality Coordinators within 2 working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the NBP Program and Quality

Coordinators. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify it.

## C2: Reports to Management

Effective management of environmental data collection requires (1) timely assessment and review of all activities, and (2) open communication, interaction, and feedback among all project participants. This section outlines the reporting requirements for activities conducted under the NBP.

### C2.1 Purpose/Background

Planned reports provide a structure for evaluating the management of program schedules, assessing the impact of deviations from approved program and project plans on data quality, and determining the potential uncertainties in decisions made based on the data. QA reports keep managers and project members informed on the performance of QA/QC activities. QA reports summarize the results of project-specific audits, list any significant problems, and discuss the solutions and corrective actions implemented to resolve QA/QC problems.

### C2.2 Frequency, Content, and Distribution of Reports

A QA report is generated by field, technical, laboratory, or QA personnel and sent to the NBP Quality Coordinator in the Bureau of Corrective Actions, at a specified frequency throughout the duration of the project. The laboratory QA report is prepared by the laboratory manager with the help of senior laboratory staff.

The contractor field team will prepare a daily progress report to summarize activities throughout the field investigation. This report will describe sampling and field measurements, equipment used, subcontractor personnel on site, QA/QC and health and safety activities, problems encountered, corrective actions taken, deviations from the QA program plan or SAP, and explanations for the deviations. The daily progress report is prepared by the field team leader and submitted to the NBP Program Coordinator. The content of the daily reports will be summarized and included in the final report submitted for the field investigation. The YSA for the NBP compiles the results of project-specific audit elements taken throughout the year.

The project team will prepare a QC summary report (QCSR) that will be submitted to the NBP Quality Coordinators, along with the final report for the field investigation. The QCSR will include a summary and evaluation of QA/QC activities, including any field or laboratory assessments, completed during the investigation. The QCSR will also indicate the location and duration of storage for the complete data packages. Particular emphasis will be placed on evaluating whether project DQOs were met and whether data are of adequate quality to support required decisions.

### C2.3 Identify Responsible Organizations

The in-text table in Section C1.3.3 of this QA Program Plan identifies the type of audit, the auditor, and the audience for the audit summary report.

## GROUP D: DATA VALIDATION AND USABILITY

### D1: Data Review, Validation, and Verification Requirements

Data verification, validation, and review are done to ensure that environmental programs and decisions are supported by data of a type and quality needed and expected for their intended use. This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet DQOs and MQOs for the project.

### D1.1 Purpose/Background

Data verification is the process of evaluating the completeness, correctness, conformance, and compliance of a specific data set against the method, procedural, or contractual requirements. Data verification evaluates whether sampling protocols, SOPs, analytical methods, and project-specific planning documents (SAPs or FSPs) were followed during data generation. Verification also involves examining the data for errors or omissions. Field and laboratory staff can verify that the work is producing appropriate outputs.

Data validation is a systematic process for reviewing a body of data against a pre-established set of acceptance criteria defined in this QA Program Plan and in project-specific SAPs. Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond data verification and is performed to determine the analytical quality of a specific data set. Validation involves a detailed examination of the data package to determine whether MQOs for precision, accuracy, and sensitivity have been met. Data validation begins with the outputs from data verification and is done to ensure that:

- QC data are scientifically sound, appropriate to the method, and completely documented
- QC samples yield results within established guidelines
- Data are appropriately flagged by the laboratory
- Anomalies in sample preparation and analysis are completely and accurately documented
- Corrective action forms, if required, are complete
- Holding times and preservations were documented
- Data are ready for incorporation into the final report
- The data package is complete and ready for data archive

### D1.2 Sampling Design

Samples should conform to the type and location specified in the project-specific SAP or FSP. Any deviations should be noted, along the likely effect on the usability of the data for its intended purpose. An overview of sampling design is also discussed in Section B1.1 of this QA

Program Plan. EPA also provides guidance in QA/G-5S ("Guidance on Choosing a Sampling Design for Environmental Data Collection") (EPA 2002).

### D1.3 Sample Collection Procedures

The data reviewer should verify that the appropriate specified methods were used during sampling. The reviewer should:

1. Evaluate the field records for consistency
2. Review QC information
3. Summarize deviations and determine their impact on data quality
4. Summarize the samples collected
5. Prepare a field data verification report

Improper field practices can compromise the useability of a data set. Specific issues to look for include mislabeling of sample containers, problems with field instruments, improper documentation (such as failure to properly fill in the log book), improper collection of VOC samples (such as leaving a cap off a container or collecting VOC samples from a well-mixed composite sample), biasing sampling locations or forgetting to obtain location information for each sample, improper purging of monitoring wells, improper decontamination procedures, or intentionally cutting corners by collecting many samples from one location to save time.

For preparation of the field data verification report, he field team leader or data reviewer would evaluates field records and notebooks for consistency with field methods and procedures described in the SAP to assure that these procedures were followed properly or that deviations from the procedures still yields data of acceptable quality. The verification report should include a summary noting (1) the consistency and completeness of field records, (2) the adequacy of field QC information, (3) any deviations from SAP procedures and the probable effect of the deviations on data quality, and (4) the number and types of samples collected and how this compares with specifications in the SAP.

SOPs for various field activities are in Appendix E of this QA program plan and additional information on SOPs is available in EPA QA/G-6 ("Guidance for Preparing Standard Operating Procedures (EPA 2001) and EPA Region 4 guidance on "Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EPA Region 4 2001). Additional guidance on soil sampling techniques and strategies is also available (EPA 1992)

### D1.4 Sample Handling

QA personnel should confirm that samples were handled in accordance with protocols required in the QA Program Plan and project-specific SAP or FSP. Sample containers and preservation methods should be confirmed appropriate for the nature of the sample and type of data generated from the sample. Chain-of-custody records and storage conditions should be checked to ensure the representativeness and integrity of the samples.

### D1.5 Analytical Procedures

Section B4 of this QA Program Plan identified the requirements of analytical methods used to generate the data. Each sample should be verified to ensure that the procedures used to generate the data were implemented as specified. Acceptance criteria follow for these data follow those used in data validation, with suitable codes to characterize any deviations from the procedure.

### D1.6 Quality Control

Section B5 of this QA Program Plan specified the QC checks that should be performed during sample collection, handling, and analysis. Here, the QA reviewer should confirm that results for QC samples were evaluated against acceptance criteria (MQOs) specified in Section B5 and Appendix D.

### D1.7 Calibrations

Section B7 of this QA Program Plan addressed the calibration of instruments and equipment and the information required to ensure that the calibrations were performed within an acceptable time prior to generation of measurement data, were performed in proper sequence, included the proper number of calibration points, were performed using standards that bracketed the range of reported measurements (linear working range of the instrument), had acceptable linearity checks to ensure the measurement system was stable when the calibration was performed.

### D1.8 Data Reduction and Processing

Internal checks by laboratory staff should verify the integrity of the raw data generated by the analyses. EDDs automatically produced by the laboratory should help minimize data entry errors. Steps in data reduction should be clearly documented so that the validity of the analysis can be properly assessed.

Data should be cross-checked to confirm consistency or comparability in analytical methods and detection limits, units of measurement, compatibility of file types or software, and other critical factors that affect how the data will ultimately be interpreted to influence conclusions and recommendations.

## D2: Validation and Verification Methods

The integrity of the data generated over the life of the project is confirmed by data verification and validation.

### D2.1 Purpose/Background

The process for determining if the data satisfy program-defined requirements involves evaluating and interpreting the data, in addition to verifying that QC requirements were met. Projects planned using EPA's DQO process should produce data that provide answers to critical study questions. As discussed below, the process of evaluating data against project DQOs is done using statistical tools and the five-step DQA process.

## D2.2 Describe the Process for Verifying and Validating Data

The process for verifying and validating data is presented in EPA's "Guidance on Environmental Data Verification and Data Validation" (EPA 2002). Section 5 of this EPA guidance provides tools and techniques for data verification and validation.

### *D2.2.1 Data Verification*

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package. All analytical data generated for NBP projects are to be verified by the laboratory.

Verified data are checked for a variety of topics including transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct usage of conversion factors, among others. Verified data may have laboratory qualifiers. Verified data are one output of this process.

A second output from the verification process is documentation, which may include a certification statement signed by the laboratory manager and included in the data package. Narratives on technical issues, non-compliance, and any corrective action taken would also be included in the laboratory data package. Records from field activities are likely to be logbooks or handwritten notes, all of which should be dated and signed.

The laboratory QA manual must be used to accept, reject or qualify the data generated by the laboratory. The laboratory management will be responsible for validating the data generated by the laboratory. The laboratory personnel must verify that the measurement process was "in control" (i.e., all specified data quality objectives were met or acceptable deviations explained) for each batch of samples before proceeding with analysis of a subsequent batch. In addition, each laboratory will establish a system for detecting and reducing transcription and/or calculation errors prior to reporting data. Only data that have met MQOs or data that have acceptable deviations explained shall be submitted by the laboratory. When QA requirements have not been met, the samples will be reanalyzed when possible and only the results of the reanalysis will be submitted, provided they are acceptable.

### *D2.2.2 Data Validation*

Data validation determines the analytical quality of data within a specific data set; it is an analyte- and sample-specific process based on achieving the MQOs set forth in the planning documents for the project. Validation assesses whether data quality goals specified in the planning phase have been achieved. Unlike data verification, which may be done by the laboratory, data validation is typically performed by a qualified person who is not affiliated with the laboratory. At present, validation of analytical data for the NBP will be contracted to an independent firm or individual outside of the NDEP.

The level of data validation depends on the size and complexity of the project and the decisions to be made. Basically, data validation is the process of evaluating the available data against the project DQOs to make sure that the objectives are met. Data validation may be very rigorous, or cursory, depending on project DQOs. Criteria for data validation are summarized in Table D-1. Many NBP projects may require only cursory validation

The personnel validating the data should be familiar with the project-specific MQOs. So, the validator should have access to the QA Program Plan, SAP or FSP, SOPs, and approved analytical methods (e.g., SW846 or ASTM protocols). The validator must identify these and other project records, obtain records produced during data verification, and validate the records by determining whether the data quality meets goals established in the planning documents.

<u>Validation of Field Data</u>

The five steps for validating field activities include:

1. Evaluate field records for completeness and consistency
2. Review field QC information
3. Summarize deviations and determine effects on data quality
4. Summarize number and type of samples collected
5. Prepare field data validation report

<u>Validation of Laboratory Data</u>

The five steps for validating laboratory data include:

1. Assemble planning documents and data to be validated
2. Review results of data verification to determine method, procedural, and contractual QC compliance or noncompliance
3. Review verified data for the data set as a whole, including laboratory qualifiers
4. Assign validated data qualifiers, which supersede laboratory qualifiers although both sets of qualifiers are retained in the database
5. Prepare data validation report

Outputs from data validation include a fully validated data set, which is ready for data analysis (including statistical analysis if warranted), and the data validation report, which is typically included as an appendix to the report presenting the results of the project investigation.

## D3: Reconciliation with Data Quality Objectives

After the data have been verified and validated, the data are evaluated against DQOs using EPA's five-step DQA process (EPA 2006). DQA completes the data life cycle by providing the assessment needed to determine if project objectives were achieved.

Two guidance documents on DQA (QA/G9-R and QA/G9-S, February 2006) are available from EPA at http://www.epa.gov/quality/qa_docs.html DQA is the scientific and statistical evaluation of environmental data to determine if they meet the planning objectives of the project, and thus are of the right type, quality, and quantity to support their intended use. QA/G9-R for project managers describes broadly the statistical aspects of DQA in evaluating environmental data sets. A more detailed discussion about graphical and statistical tools may be found in the companion guidance document on statistical methods for practitioners (QA/G-9S)

These EPA guidance documents discuss the use of DQA to support environmental decision-making (e.g., compliance determinations). DQA is built on a fundamental premise: data quality is meaningful only when it relates to the intended use of the data. Data quality does not exist in a vacuum, a reviewer needs to know in what context a data set is to be used in order to establish a relevant yardstick for judging whether or not the data is acceptable. By using DQA, a reviewer can answer four important questions:

1. Can a decision (or estimate) be made with the desired level of certainty, given the quality of the data?

2. How well did the sampling design perform?

3. If the same sampling design strategy is used again for a similar study, would the data be expected to support the same intended use with the desired level of certainty?

4. Is it likely that sufficient samples were taken to enable the reviewer to see an effect if it was really present?

### D3.1 Purpose/Background

This section outlines methods for evaluating the results obtained from the sampling and analysis. Scientific and statistical evaluations of the data are used to determine if the data collected are of the right type, quantity, and quality to support their intended use and to adequately address the primary study questions.

### D3.2 Reconciling Results with Program Objectives or DQOs

EPA guidance documents for data evaluation (EPA 2006b and c) describe an iterative five-step process:

1. Review the DQOs and sampling design described in the project planning documents.

2. Conduct a preliminary data review or exploratory data analysis to understand the character and structure of the data set and to evaluate whether there are any anomalies in the data that may not have been noticed during data verification and validation. Are there outliers or other anomalies that should be further investigated (i.e., conduct a focused data validation) before continuing with statistical testing?

3. Select a statistical test. Choose appropriate statistical tests based on the characteristics of the data and the questions that the investigation was intended to address.

4. Verify the assumptions of the statistical tests and assess the impact that violations of tests assumption may have on the result (i.e., is the test sufficiently robust?) Are there effects of seasonality that must be considered? Would alternative statistical tests be better suited to the data than the tests proposed in the planning documents?

5. Draw conclusions from the data. Using multiple lines of evidence, the results of statistical tests, and professional experience, the data analyst should be able to provide conclusions and recommendations for the site. In some case, the conclusion may be that more data are needed to answer the primary study questions.

If DQOs have not been adequately developed, the analyst may need to review the planning documents and sampling design and define the statistical hypotheses to be tested and establish tolerable limits on decision errors. Tables D2 and D3 to this QA Program Plan provide example summary tables for a statistically based and a non-statistically based set of DQOs. As the DQA process progresses, the data analyst may note anomalies during exploratory data analysis. The analyst may return to the validator and request a "focused data validation" to try and determine the cause of the anomalies.

When the DQOs are qualitative and statistical tools are not appropriate, the NDEP will still systematically assess data quality and data usability. This assessment will include the following:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives

- A review of project-specific MQOs for precision, accuracy, representativeness, completeness, comparability, and quantitation limits to evaluate whether acceptance criteria have been met

- A review of project-specific DQOs to assess whether they have been achieved by the data collected

- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared to a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

### *D3.2.1 Review the DQOs and the Sampling Design*

The objectives of the study should be reviewed in order to provide a context for analyzing the data. If a systematic planning process has been implemented before the data are collected, then this step reviews the study objectives to evaluate whether project goals have been met and whether the study questions have been adequately answered. If no clear planning process was used, the reviewer should:

- Develop a concise definition of the problem (DQO Step 1) and of the methodology of how the data were collected (DQO Step 2). This should provide the fundamental reason for collecting the environmental data and identify all potential actions that could result from the data analysis.

- Identify the target population (universe of interest) and determine if any essential information is missing (DQO Step 3). If so, either collect the missing information before proceeding, or select a different approach to resolving the problem.

- Specify the scale of determination (any subpopulations of interest) and any boundaries on the study (DQO Step 4) based on the sampling design. The scale of determination is the smallest area or time period to which the conclusions of the study will apply. The apparent sampling design and implementation may restrict how small or how large this scale of determination can be.

The overall type of sampling design and the manner in which data were collected will likely place constraints on how the data can be used and interpreted. The data analyst should assess whether features of the design support or contradict the stated objectives of the study. Were there deviations from the planned design? What might be the effect of these deviations? Are data adequate to address the primary study questions? How do these objectives translate into statistical hypotheses (null and alternative hypotheses)?

The design and sampling strategy should be discussed in clear detail in the project-specific SAP or FSP. The overall type of sampling design and the manner in which samples were collected or measurements were taken will place conditions and constraints on how the data can be used and interpreted.

A key distinction in sampling design is between judgmental (also called authoritative or biased) sampling (in which sample numbers and locations are selected based on expert knowledge of the problem) and probability-based sampling (in which sample numbers and locations are selected based on randomization, and each member of the target population has a known probability of being included in the sample). Judgmental sampling has some advantages and is appropriate in some cases, but the reviewer should be aware of its limitations and drawbacks. This type of sampling should be considered only when the objectives of the investigation are not of a statistical nature (for example, when the objective of a study is to identify specific locations of leaks, or when the study is focused solely on the sampling locations themselves). Generally, conclusions drawn from judgmental samples apply only to those individual samples; aggregation may result in severe bias due to lack of representativeness and lead to highly erroneous conclusions if statistical tests are used on biased data.

Judgmental sampling, although often rapid to implement, generally precludes the use of the sample data for any purpose other than the original one. If the reviewer elects to proceed with judgmental data, then great care should be taken in interpreting any statistical statements concerning the conclusions to be drawn. Using a probabilistic statement with a judgmental sample should be avoided because it implies a level of statistical certainty that is incorrect. The further the judgmental sample is from a truly random sample, the more questionable the conclusions based on statistical tests.

Probabilistic sampling typically takes more effort to implement than judgmental sampling, because systematic or random locations must be selected for sampling. However, a probability-based sampling design has the advantage of allowing the use of statistical tests, which permit confidence and uncertainty of the results to be specified. Probability-based designs do not preclude the use of expert knowledge or the use of existing data to establish the sampling design. An efficient sampling design is one that uses all available prior information to stratify the site (in order to improve the representativeness of the resulting samples) and set appropriate probabilities of selection.

Common types of probabilistic sampling designs include the following:

- Simple random sampling – the method of sampling where samples are collected at random times or locations throughout the sampling period or study area.

- Stratified sampling – a sampling method where a population is divided into nonoverlapping subpopulations called "strata," and sampling locations are selected randomly within each stratum using a random or systematic sampling design.

- Systematic sampling – a randomly selected unit (in space or time) establishes the starting place of a systematic pattern that is repeated throughout the population. With some important assumptions, can be shown to be equivalent to simple random sampling.

- Ranked set sampling – a field sampling design where expert judgment or an auxiliary measurement method is used in combination with simple random sampling to determine which locations should be sampled.

- Adaptive cluster sampling – a sampling method in which some samples are taken using simple random sampling, and additional samples are taken at locations where measurements exceed some threshold value.

- Composite sampling – a sampling method in which multiple samples are physically mixed into a larger sample and samples for analysis drawn from this larger sample. This technique can be highly cost-effective (but at the expense of variability estimation) and had the advantage it can be used in conjunction with any other sampling design.

Regardless of the type of sampling scheme, the reviewer should review the description of the sampling design and look for design features that support the project's objectives. For example,

if the goal of the study was to make a decision about the average (defined here as the arithmetic mean) concentration of a contaminant in an effluent stream over time, then composite samples may be an appropriate sampling design. . On the other hand, if the goal of the study was to find hot spots of contamination at a hazardous waste site, compositing should be used with caution, to avoid "averaging away" hot spots.

The reviewer should also look for potential problems in the implementation of the sampling design. For example, if simple random sampling was used to collect the data, can the reviewer be confident that the sampling locations or data point were truly random? Small deviations from a sampling plan probably have minimal effect on the conclusions drawn from the data set, but the effects of significant or substantial deviations should be carefully assessed. Finally, the reviewer should verify that the data are consistent with the project-specific SAP or FSP and the overall objectives of the study.

Step 1 of the DQA process should (1) document or define the project specific DQOs, (2) verify that the hypothesis is consistent with project objectives, and (3) identify any deviations from the sampling plan and assess the potential effect of the deviations.

### *D3.2.2 Conduct a Preliminary Data Review*

Step 2 of the DQA process reviews graphical representations of the data and calculates some basic statistical quantities. By reviewing the data both numerically and graphically, the reviewer can understand the structure of the data, and thereby identify appropriate use of the data.

Statistical quantities numerically describe the data. The quantities typically calculated include the arithmetic or geometric mean, the median and other percentiles, and the standard deviation. These quantities provide estimates of characteristics for the sample population and allow one to make inferences about the population from which the data were drawn. Graphical representations permit the reviewer to identify patterns and relationships within the data, confirm or disprove assumptions, and identify potential problems.

1. The preliminary data review allows the reviewer to understand the structure and characteristics of the data set and the population from which these data were drawn. Graphical depictions of the data permit the analyst to identify anomalies that may require further investigation or perhaps even reanalysis by the laboratory. Output from Step 2 includes (1) tables of summary statistics and (2) graphs and/or statistical plots of the data.

### *D3.2.3 Select a Statistical Test*

Under Step 3 of the DQA process, the data analyst or review selects the most appropriate statistical test or method for evaluating the data. The statistical method will be selected based on the sampling plan used to collect the data, the type of data distribution, assumptions made in setting the DQOs, noting any deviations from these assumptions. Conclusions about the null hypothesis or other aspects of the data set are made based on the results of this evaluation. EPA DQA guidance provides a discussion (with mathematical formulas and examples for conducting statistical tests) of the process for evaluating environmental data. Detailed technical information

that reviewers can use to select appropriate procedures may be found in Chapter 3 of Data Quality Assessment: Statistical Methods for Practitioners (2006c) (EPA QA/G-9S).

If a particular statistical procedure was specified in the project work plan, the reviewer should use the results of the preliminary data review to determine if the procedure is appropriate for the data collected. If not, then the reviewer should document why the procedure is deemed inappropriate, and then select a different method. Chapter 3 of Data Quality Assessment: Statistical Methods for Practitioners (2006c) (EPA QA/G-9S) provides alternatives for several statistical procedures. If a particular procedure has not been specified, then the reviewer should select a statistical test or method based on the study objectives, results of the preliminary data review, and key assumptions necessary for the method.

All statistical tests make assumptions about the data. For instance, parametric tests assume some distributional form, such as the t-test assuming that the data approximate a normal distribution. In contrast to parametric tests, nonparametric tests make much weaker assumptions about the distributional form of the data. However, both parametric and nonparametric tests assume that the data are derived from statistically independent samples Common assumptions include distributional form of the data, independence, dispersion characteristics, approximate homogeneity, and the basis for randomization in the sampling design. For example, the one-sample t-test needs random and independent samples, a sample mean that is approximately normally distributed, no outliers, and no more than a small percentage of nondetections. .

Statistical methods that are insensitive to small or moderate departures from the assumptions are called "robust." However, some tests rely on the data meeting certain key assumptions in order for the test results to be valid. The reviewer should note any sensitive assumptions where relatively small deviations could jeopardize the validity of the test results.

After completing Step 3 of the DQA process, the data analyst or reviewer should have selected appropriate statistical tests and noted the critical assumptions of the statistical tests.

### *D3.2.4 Verify Assumptions of the Statistical Tests*

The validity of a statistical test or method depends on the key assumptions underlying the test, and whether the data to be tested violate these assumptions. Minor deviations from assumptions are usually not critical if the statistical technique is sufficiently robust to compensate for such deviations.

If the data do not show serious deviations from the key assumptions of the statistical method have occurred, then the DQA process continues to Step 5, 'Drawing Conclusions from the Data.' However, it is possible that one or more of the assumptions may be called into question, and this could result in a reevaluation of which tests may be appropriate for the data. It is true that some deviations do not invalidate the results of a statistical test, but this should be confirmed here in Step 4 of the DQA process. For example, deviation from normality may not be seriously important for a very large sample size, but would be critically important for a small sample size.

This step in the DQA process is an important check on the validity and reliability of the conclusions to be drawn. Outputs from this step include documentation of the method used to

verify assumptions and verification that the test results are valid. Additionally, the reviewer should provide a description of any corrective actions that were taken.

### *D3.2.5 Draw Conclusions from the Data*

Step 5 of the DQA process represents the culmination of the planning, implementation, and assessment phases of the project operations. In this step, the reviewer or data analyst draws conclusions that address the project objectives. All of the analysis and review conducted in Steps 1 through 4 should ensure that the conclusions drawn in Step 5 adequately address project objectives in a scientifically defensible manner.

In Step 1, the project objectives are reviewed (or developed retrospectively) and the sampling design is evaluated.. In Step 2, the implementation of the sampling scheme is reviewed and a preliminary picture of the data set is developed. In Step 3, the appropriate statistical tests are selected. Finally, the underlying assumptions of the statistical test are verified in Step 4.

Conclusions drawn in the final step of the DQA process allow the reviewer or data analyst to present valid statistical results with a specified level of significance. The confidence and power of the tests are stated, along with the study conclusions in plain English. Finally, the reviewer or data analyst provides an assessment of the overall performance of the sampling design and identifies additional data that may be needed (that is, data gaps are identified).

If data were collected using a judgmental sampling design or if few samples were collected, professional judgment rather than formal statistical testing may be applied to draw conclusions. . Or, statistical tests may be applied, recognizing that the results may present a biased "worst case scenario." For example, if the data from biased samples (say, selective sampling of visibly stained soils) are used in a one-sample statistical test to compare concentrations against a cleanup standard or action level, and test results show that concentrations do not exceed the action level, then a conclusion can be drawn. If test results show that concentrations do exceed the action level, then conclusions should balance this result with the knowledge that the data were biased toward "hot spots."

## D4 Revisions to the QA Program Plan

Throughout the life of the NBP, there may be changes to program requirements, or modifications to the way environmental data are collected, or changes to how enforcement activities are defined. Therefore, this QA Program Plan is recognized as a dynamic document that is subject to revision, as needed. The NBP Program and Quality Coordinators will examine and revise this QA Program Plan annually, although the plan will only be resubmitted to EPA Region 9 QA manager for review once every five years.

**Table D1. Criteria for Cursory and Full Data Validation**

| Analytical Group | Criteria for Cursory Data Validation | Criteria for Full Data Validation |
|---|---|---|
| CLP Organic Analyses | Holding times<br>Calibration<br>Blanks<br>Surrogate recovery<br>Matrix spike and matrix spike duplicate recovery<br>Laboratory control sample or blank spike<br>Internal standard performance<br>Field duplicate sample analysis<br>Overall assessment of data for an SDG | Holding times<br>Gas Chromatography/Mass Spectroscopy tuning<br>Calibration<br>Blanks<br>Surrogate recovery<br>Matrix spike and matrix spike duplicate recovery<br>Laboratory control sample or blank spike<br>Internal standard performance<br>Field duplicate sample analysis<br>Compound identification<br>Target compound list identification<br>Compound quantitation and reported detection limits<br>Tentatively identified compounds<br>System performance<br>Overall assessment of data for an SDG |
| CLP Inorganic Analyses | Holding times<br>Calibration<br>Blanks<br>Matrix spike recovery<br>Matrix duplicate sample analysis<br>Laboratory control sample or blank spike<br>Field duplicate sample analysis<br>ICP serial dilution<br>Overall assessment of data for an SDG | Holding times<br>Calibration<br>Blanks<br>ICP interference check sample<br>Matrix spike recovery<br>Matrix duplicate sample analysis<br>Laboratory control sample<br>Field duplicate sample analysis<br>Graphite furnace atomic absorption QC<br>Sample result verification<br>ICP serial dilution<br>Detection limits<br>Overall assessment of data for an SDG |

| | | |
|---|---|---|
| Non-CLP Organic Analyses | Method compliance<br>Holding times<br>Calibration<br>Blanks<br>Surrogate recovery<br>Matrix spike and matrix spike duplicate recovery<br>Laboratory control sample or blank spike<br>Internal standard performance<br>Field duplicate sample analysis<br>Other laboratory QC specified by the method<br>Overall assessment of data for an SDG | Method compliance<br>Holding times<br>Calibration<br>Blanks<br>Surrogate recovery<br>Matrix spike and matrix spike duplicate recovery<br>Laboratory control sample or blank spike<br>Internal standard performance<br>Field duplicate sample analysis<br>Compound identification<br>Detection limits<br>Compound quantitation<br>Sample results verification<br>Other laboratory QC specified by the method<br>Overall assessment of data for an SDG |

Notes:
CLP Contract Laboratory Program
ICP Inductively coupled plasma (emission spectroscopy)
SDG Sample delivery group
QC Quality control

## Table D2. Example of a Summary DQO Table for a Statistically Based Study.

| STEP 1 | STEP 2 | STEP 3 | STEP 4 | STEP 5 | STEP 6 | STEP 7 |
|---|---|---|---|---|---|---|
| **State the Problem** | **Identify the Decisions** | **Identify the Inputs to the Decisions** | **Define Study Boundaries** | **Develop Decision Rules** | **Specify Tolerable Limits on Errors** | **Optimize Sampling Design** |
| Areas of radioactively contaminated soils have been identified and removed from the site; however, existing data for radionuclides and radiogenic indicator parameters (gross alpha and gross beta) in samples of sitewide groundwater and soils collected at the site do not provide sufficient coverage to make defensible remedial decisions for groundwater. Data are also very limited for local background activities of specific radioisotopes.<br><br>Isotope-specific data are needed to evaluate whether there is site-related radioactive contamination in groundwater at the site, and if so, to delineate the extent of the contamination. | (1) Do the levels of radionuclide species in groundwater from the site exceed regulatory limits?<br><br>(2) Do the activities of radionuclide species in groundwater from background areas (including seawater) exceed regulatory limits?<br><br>(3) Has groundwater in areas of radioactively contaminated soils been affected by leaching of site-related radionuclides from soils and into shallow groundwater, such that activities are significantly above background levels?<br><br>(4) Are high activities of gross beta reported in the existing data set the result of naturally occurring potassium-40 derived from seawater (K-40 mean = 300 pCi/L) or are the beta activities the result of site-related radionuclides? | * New and existing analytical data (validated and defensible) for specific radionuclides in samples of shallow groundwater collected from site and background areas within and outside of the site, including seawater.<br><br>* Historical documentation and personnel knowledge regarding the handling, treatment, and storage of radioactive materials at the site.<br><br>* Supporting data for groundwater samples including TSS, TDS, pH, and conductivity.<br><br>* Background data reported in the literature for radionuclides and radiological indicators.<br><br>* Hydrogeologic information including water level, gradient, seasonal fluctuations, and flow directions.<br><br>* Information on well construction, depth of screened intervals, and well production volumes.<br><br>* PRGs or other regulatory screening levels for radionuclides.<br><br>* Knowledge of the geochemical behavior of various radioactive elements. | The lateral boundary of the study area includes wells throughout the site and off-site areas for additional background samples.<br><br>The vertical boundary of the study extends from 0 feet bgs and into shallow groundwater.<br><br>The temporal boundary of the study is constrained by the period of performance, which is estimated to be 12 months. | (1a) If levels of radionuclides in site samples exceed regulatory limits, then site data will be compared with background data.<br><br>(1b) If levels of radionuclides do not exceed regulatory limits, then the groundwater will not be further evaluated or remediated.<br><br>(2a) If background radioactivity exceeds regulatory limits, realistic cleanup goals for radioactivity at the site will be established, such that the cleanup levels are not below background.<br><br>(2b) If background radioactivity does not exceed regulatory limits, then regulatory limits or a site-specific cleanup level will be used at the site.<br><br>(3a) If analytical data show statistically significant differences in the activities of radionuclides in site and background waters, then site groundwater in the area will be further evaluated and remedial action may be recommended.<br><br>(3b) If analytical data show statistically indistinguishable activities of radionuclides in site and background waters, then site groundwater in the area will be considered not contaminated and remediation will not be recommended.<br><br>(4a) If gross beta activity correlates strongly with naturally occurring activities of K-40 in seawater, then gross beta will not be used as an indicator for site-related effects.<br>(4b) If gross beta activity shows no correlation with naturally occurring activities of K-40, then gross beta may be used as an indicator for site-related effects. | Measurement quality objectives (MQOs) will be established for sample analyses, and the analytical data will undergo QA/QC review to ensure that MQOs are met.<br><br>Appropriate parametric or nonparametric one-sample or two-samples tests will be used to compare radionuclide activities to cleanup levels or to a background population, with a 95 percent level of confidence (that is, the null hypothesis that the site data do not exceed regulatory limits [one-sample tests] or that data sets are taken from the same population [two-sample tests] will be rejected if the p-value for the statistical test is less than 0.05).<br><br>MDAs reported by the laboratories will be compared with regulatory limits to make certain that analytical methods are sufficiently sensitive. | Groundwater sampling is limited to existing wells (at this point, no new wells will be installed for the data gap sampling).<br><br>Two rounds of sampling will be collected from 37 existing monitoring wells. Five of the 37 are background wells and the remaining 32 wells include those near areas where radioactively contaminated soils have been identified, in areas downgradient of buildings where radioactive materials were handled or stored, and in other areas to provide adequate spatial coverage across the site. In addition, samples of seawater and potable water will be collected and analyzed. |

**Table D3. Example of a Summary DQO Table for a Non-Statistically Based Study.**

| STEP 1<br>State the Problem | STEP 2<br>Identify the Decisions | STEP 3<br>Identify the Inputs to the Decisions | STEP 4<br>Define Study Boundaries | STEP 5<br>Develop Decision Rules | STEP 6<br>Specify Tolerable Limits on Errors | STEP 7<br>Optimize Sampling Design |
|---|---|---|---|---|---|---|
| Five geophysical anomalies thought to be buried metallic objects were noted at the site during an airborne geophysical survey in 1994. These anomalies are immediately upgradient of a VOC plume in groundwater and may indicate the presence of buried drums or tanks that are the source of VOCs in downgradient groundwater.<br><br>A ground-based geophysical survey and soil gas sampling are needed to evaluate the geophysical anomalies as the potential source of VOC contaminants in groundwater.<br><br>Additionally, excavation and soil sampling may be needed to further characterize and delineate the extent of contamination. | 1) Can the locations and signatures of the geophysical anomalies be determined with certainty, using the ground-based EM-31 and magnetometer surveys?<br><br>2) Does soil gas in the area of the anomalies contain elevated levels of VOCs?<br><br>3) Are subsurface soils around the buried objects contaminated with VOCs? That is, do these soils contain significant amounts of VOCs?<br><br>4) If contaminated soils are found, what is the lateral and vertical extent of the contamination? | Historical analytical data for contaminants at each site.<br><br>Validated defensible chemical data for soil samples collected at each site.<br><br>Land survey and GPS location data.<br><br>Toxicological and risk management data, in the form of site-specific action levels. | The proposed lateral boundaries of each site are shown in Figures X, Y, and Z. Lateral boundaries may be extended based on step-out sampling.<br><br>The vertical boundaries extend from the land surface to the water table<br><br>The temporal boundary of the study is anticipated to be 18 months. | 1a) If the locations and signatures of the geophysical anomalies can be determined with certainty, using the ground-based EM-31 and magnetometer surveys, then plot exact locations of anomalies on contoured maps of the site and use these to direct future sampling.<br><br>1b) If the locations and signatures of the geophysical anomalies cannot be determined with certainty, using the ground-based EM-31 and magnetometer surveys, then conduct exploratory excavations to locate anomalies.<br><br>2a) If samples of soil gas contain elevated concentrations of VOCs near the anomalies, then collect subsurface soil samples for analysis and pursue investigation of anomalies as the sources of VOC contamination.<br><br>2b) If samples of soil gas do not contain elevated concentrations of VOCs near the anomalies, then pursue investigation of other possible sources.<br><br>3a) If subsurface soils around the buried objects contain significant amounts of VOCs, then these soils, along with any potential source (e.g., leaking drum), will be excavated and disposed of at an appropriate disposal facility. Additional step-out samples will be collected to delineate the lateral and vertical extent of the contamination.<br><br>3b) If subsurface soils do not contain significant amounts of VOCs, then the study will pursue investigation of other possible sources for the VOC plume in downgradient groundwater. | The number of samples to be collected is not statistically based and will depend on the number of step-out samples needed to delineate the areal extent of contamination. The location and number of samples collected will be based on professional judgment.<br><br>MQOs established for analytical data are described in the SAP. | The number and type of samples to be collected at the site will be based on professional judgment using the results from the previous survey/ sampling activity conducted during this project.<br><br>The number and type of samples will also consider budget and schedule constraints for this project. |

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EPA. 2006c. Data Quality Assessment: Statistical Methods for Practitioners. EPA QA/G-9S. EPA/240/B/05-003. February.

**EPA Quality System Documents Are Available On-Line at:**
www.epa.gov/quality/qa_docs.html

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|---|---|
| EPA QA/G-1 | *Guidance for Developing Quality Systems for Environmental Programs* |
| EPA QA/R-2 | *EPA Requirements for Quality Management Plans* |
| EPA QA/G-3 | *Guidance on Assessing Quality Systems* |
| EPA QA/G-4 | *Guidance for the Data Quality Objectives Process* |
| EPA QA/G-4D | *Decision Error Feasibility Trials (DEFT) Software* |
| EPA QA/R-5 | *EPA Requirements for Quality Assurance Project Plans* |
| EPA QA/G-5 | *Guidance for Quality Assurance Project Plans* |
| EPA QA/G-5G | *Guidance for Geospatial Data Quality Assurance Project Plans* |
| EPA QA/G-5M | *Guidance for Quality Assurance Project Plans for Modeling* |
| EPA QA/G-5S | *Guidance on Choosing a Sampling Design for Environmental Data Collection* |
| EPA QA/G-6 | *Guidance for Preparation of Standard Operating Procedures* |
| EPA QA/G-7 | *Guidance on Technical Audits and Related Assessments for Environmental Data Operations* |
| EPA QA/G-8 | *Guidance on Environmental Data Verification and Data Validation* |
| EPA QA/G-9 | *Guidance for Data Quality Assessment: Practical Methods for Data Analysis* |
| EPA QA/G-10 | *Guidance for Developing a Training Program for Quality Systems* |